Department of Development
Government of Newfoundland and Labrador

PROCEEDINGS

of a seminar on

SCIENCE POLICY

for

Newfoundland & Labrador

Hon. H. Ned Windsor, P. Eng.
Minister of Development

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PROCEEDINGS

of a seminar on

Science Policy

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Sponsored by

Department of Development

Government of Newfoundland and Labrador

March 17-18, 1982

Hotel Newfoundland

St. John's

Edited by Rex Gibbons and Paul Maher

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FOREWORD

I would like to thank all those who attended and participated in the Seminar on the Province's White Paper "Towards a Science Policy for Newfoundland and Labrador". I am deeply grateful to those people who acted as chairmen of the various panel groups and those who took part as panelists. Especially, I would like to extend a sincere thanks to those who came from other provinces to discuss with us their firsthand views and problems associated with the development and implementation of a science policy in their jurisdictions. The frank discussion and viewpoints expressed will be of significant value to us in the redrafting of a science policy for this province.

Finally, I would like to thank the editors and typists for the preparation of this publication.

Ivan Palmer.

IVAN PALMER
Assistant Deputy Minister
Department of Development

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The Seminar on the White Paper "Towards a Science Policy for Newfoundland" at the Hotel Newfoundland, St. John's, on March 17-18th, 1982.

The opening remarks were made by Mr. Ivan Palmer, the Assistant Deputy Minister of Development, Government of Newfoundland and Labrador.

Palmer: The purpose of this seminar is to elicit the many views of (1) what the need is for government support of R & D in the province, (2) why the need exists and (3) how it can best be met. The White Paper arose from internal discussions within the provincial government and some surveys of what was then the existing R & D activity in which the provincial government had any kind of a supporting or sponsoring role. The White Paper is, therefore, a starting point for the further discussions which begin today. In that connection, we have in some cases already solicited, and we do now solicit, written comments and responses to the White Paper from any interested individual or agency. An old colleague of mine used to start to tackle every problem by asking three questions: Why do it now? Why do it this way? Why do it at all? And, really, these are good questions on which to base discussions on R & D activity in Newfoundland and Labrador and the question of provincial government support for these activities.

To that end, we have invited a number of people from elsewhere in Canada, who have, in many cases, a long experience or relationship with R & D in the various provinces and in the federal government. I'll take the liberty of asking them to stand and be recognized. Gordon Trick of the Manitoba Research Council; Tom Pepper, Saskatchewan Research Council; Paul Dufour of the Science Council of Canada; Peter Lewell of the New Brunswick Productivity Council; Ozzie Silverman from MOSST (Ministry of State for Science and Technology); Bill Coderre from the National Research Council; Don Le Roy from the Science Council of Canada; and Director, Ross Pottie, from the National Research Council, Atlantic Region. I will not carry on these introductions to all the local participants, but I'm sure that, even though this is a small town, there are still introductions to be made, and acquaintances to be remade, on occasions of this kind.

This White Paper starts with an assumption, a very basic premise, that provincial government spending is required on science and technology activities, on R & D in general. We might even wish to question that premise in the course of these meetings. It is an assumption that has been acted upon in almost every other province in Canada and that's why we've invited the various participants from elsewhere to broaden our appreciation of the diversity in approaches to be taken with this question by reference to their own experiences. Throughout, the White Paper uses the term "Research and Development" in certain defined ways. You might want to discuss that particular definition. The paper is an attempt to express the government's desires concerning the direction which R & D in the province should take. And it does that with the purpose of encouraging certain developments as levers to raise the rate of economic development. That in itself is quite a constricting Terms of Reference and you may wish to discuss that degree of restriction. The White Paper expressly omits consideration of the social sciences, and that omission may be worthy of discussion. It emphasizes putting priority for increasing support for research in the area of renewable resouce development. In this respect, it singles out particularly R & D related to developments in the marine sector. Again, in an attempt to focus rather narrowly on some specific objectives rather than spread the fire, I think the varied approach is one that certainly should be called into question during these discussions. The White Paper

recommends that new spending be directed to the applied sciences or to research which immediately feeds these aplied sciences. Again, there are questions there for the research community.

As far as strategy goes, the White Paper advocates that Newfoundland should foster what is called "the leap-frog approach", which perhaps means an adaptive rather than an original research approach to problem solving. Again, it is very important to discover what it means for the research community to carry out the research under this spectrum. As a means for communication between government and the science and technical communities, it proposes that a Science Council be formed. The need for this council and the form that it should take are also matters for discussion.

The White Paper refers to some specific goals in spending as related to the Gross Provincial Product. It talks about increases in funding for R & D. It talks about technology transfer and the need for managerial training. It talks about the growth of marine-related R & D institutions here in Newfoundland and Labrador in the last number of years. It advocates the start-up of common user facilities. All these subjects should be examined in some detail. There are also many subjects that the White Paper does not discuss, and these also should emerge as the discussions go on. There are many varied opinions to be aired on the contents, and the omissions, of the White Paper, and to get them aired I hope that the "Spirit of the Irish" will descend on this day and bestow the gifts of tongues on all present.

Now, I will introduce the chairman of the first panel session, Dr. Bob Dempster, who is Professor of Engineering at Memorial, and get things started.

Panel # 1: Local Responses to the White Paper

Chairman: Dr. R. Dempster, Memorial University of Newfoundland (Engineering)

Panelists: Dr. Richard Haedrich, Memorial University of Newfoundland (NICOS)
Mr. Frank Smith, Newfoundland Oceans Research and Development Corporation (NORDCO)
Dr. Niall Gogan, Memorial University of Newfoundland (Research)

Dempster: Before I introduce the panelists and ask them to give a brief presentation, I would like to remind you that the title of the White Paper is "Towards a Science Policy for Newfoundland". The key word is "Towards". The White Paper, in a sense, is a start and, as the panelists make their presentations, and afterwards as you contribute to the discussion, I would like for you to bear in mind that we are starting and give some special attention to some of the concepts expressed in the White Paper such as the concept of a Newfoundland Science Council, the concept of research priorities and the others. Also, perhaps, think about the emphasis we should place on education and training in the science and engineering fields if we want to move towards a stronger science policy. Ivan has raised this point and I think it is very important. We would also like to hear your views on the advisability of making social science R & D an integral part of any science policy for the province. I think that's important because any economic development always brings about social change and, in order to cope with social change, we have to do research beforehand to try to understand it.

There are three panelists for this session. The format is that the panelists will talk for 5 - 7 minutes each. Since we have about an hour and a half for the whole session, there will be plenty of time afterwards for general discussion.

Dr. Richard Haedrich is Professor of Biology and Director of NICOS (Newfoundland Institute of Cold Ocean Sciences) at Memorial University. He was educated at Harvard and, for sixteen years, was a research scientist at Woods Hole Oceanographic Institution. He is a very appropriate member of the panel as he has had a long term interest in looking at how science and policy interact. He was a member of the American Association for the Advancement of Science committee on public understanding of science.

Dr. Niall Gogan is a Professor of Chemistry and Director of the Office of Research at Memorial. He was educated at the National University of Ireland in Dublin. He joined Memorial in 1967 and has been active in the administrative levels there. He has also been a research consultant on science policy to the federal government.

Mr. Frank Smith is President and Chief Executive Officer of NORDCO as well as Chairman and Chief Executive Officer of Geonautics Limited, a geophysical company in St. John's. He is a registered Professional Engineer in Newfoundland and Quebec. He has over 20 years of professional experience in communications and remote control engineering. In addition to this very interesting professional experience, he has also had considerable exposure to project management.

All three members of the panel are very appropriate speakers today. They will be giving their responses to the White Paper.

Gogan: First, I thank Ivan Palmer for inviting me to be part of this panel this morning. When I received the invitation, I was asked specifically to give the overall university response to the White Paper, so what I will be saying will not be just my own ideas but will be a collection of broad comments on the White Paper. I should say that when our President, Dr. Harris, first heard about the White Paper, he thought it would be useful for the government to receive this overall broad response and gathered together a small group to help draft our response. This group consisted of the Dean of Science, the Dean of Medicine, the Associate Dean of Engineering and the Directors of C-CORE and the MSRL, with myself as Chairman, and we got other input from various parts of the university. I want to make it clear, of course, that one of the bases of a university is freedom of thought with freedom of expression and we know that other people from Memorial will not only amplify on what I am going to say but will also, on some occasions, disagree with it.

The overall reaction to the White Paper was one of enthusiasm for the government in addressing this question. We thought it was very apt and that the recognition of science and technology in development was a first major step. I agree with what our Chairman has just said, that the White Paper is a basic first step "Towards a Science Policy for Newfoundland". Obviously, there is a lot more work to be done before the implementation of a policy.

(1) The key recommendation of the White Paper is really the creation of a Newfoundland Science Council and there was a generally favorable response to this suggestion, so Memorial will support the creation of a Newfoundland Science Council.

(2) In consideration of priority areas and the focus on marine sciences, if one takes the definition of science very broadly, I think that's a sensible way to focus.

(3) We were particularly pleased to note that manpower needs would form an important part of the policy. If we are going to promote science and technology as a means for development, we want Newfoundlanders to be intimately involved. The only way to do that is to ensure that they get the proper education to participate.

(4) In an overall sense, we would like to see a science policy set in a broader philosophical context than it seems to be in the White Paper. Of course, the fact that things are missing from the paper doesn't necessarily mean that the government hasn't considered them. Certainly, science and technology are essential for development but true development will only occur if science and technology are set in the context of human need.

One reference was made in the introduction to the social and economic aspects. We must not lose sight of the social consequences of our science and technology. This is particularly so in the Newfoundland context, where our way of life has not been based on high science and high technology.

There are a number of other important points in the Memorial response, but I do not want to cover them all in detail now. I'd like to see other people from Memorial take up on these various points. Since I'm supposed to speak for only five to ten minutes, I'll stop now with that overall view, but certainly would be happy to elaborate later.

Haedrich: I would like to thank Ivan Palmer for making it possible for us to come here and share some of our views with you. Again, as has been stressed, I think the aim of this meeting is to try to get views and comments from all of you who are visitors from across Canada so I will try to be brief. It is very difficult to know how to respond to White Papers of any sort because they are, by their very nature, rather generally stated. What one can say certainly is that this is a step in the right direction. From my own point of concern, I am delighted to see that ocean sciences are stressed because they are a very natural concern here in Newfoundland. In particular, there is opportunity in the natural emphasis that would fall on cold oceans. These are little studied anywhere in the world. Rather little is known about them and, in fact, most research in cold oceans takes place in the Soviet Union or here.

The views which Niall Gogan has expressed on the part of Memorial are ones which I share in general and reflect the way that many people at Memorial feel. Instead of picking on individual points, I want to look at something else.

In the letter that Ivan sent to us, he pointed out that the subject of this seminar was to be "the future shape of provincial support for science and technology in this province". I would like to say a few words about that.

The need for research, and I use that in the very broadest sense, and the need for manpower come together as a matter of course in the educational arena. It is my very strong view that graduate education and good research are inextricably bound with one another. Thus, a very good case can be made for general funding for graduate student support. This is something that was not really stressed in the White Paper but that I see as very important for the shape that provincial support might take. What one is doing in supporting graduate student research is training scientists and people who are analyzers and synthesizers of scientific information, not just technicians.

In that respect, it is important for the government to determine the sorts of things to be supported, and in fact to identify specific areas and provide funding within them. At the same time, the government must be very careful

about becoming too strictly project oriented. Area orientation with a little focus is better than focusing on individual projects. The very best science stems from curiosity, and that basically is a way of thinking about problems more than anything else. The technical skills are very important parts of the whole, but science is really a way of thinking.

Support from government can be an inducement for scientists to study one thing or another, but it is the interest in the scientific question that is the most important. Therefore, what I come back to again is the idea of general support and, furthermore, support that has to be provided on a long-term basis. One cannot proceed on a year-to-year basis identifying different things to be supported. That only creates confusion.

When we say support, we think of money most commonly, but a very important form of support is in having a White Paper like the one in front of us, and for people who are engaged in research to realize that government is thinking about the problem. That is quite encouraging.

I have one other point. It is that good science has a multiplying effect. If one scientist does good and interesting work, this gathers and stimulates other scientists both locally and from elsewhere. Successful science draws support from other governmental agencies, from private areas and even from outside the country for especially good projects. The sort of thing that government should be very careful to do here is to support the good scientists, those who have the real curiosity, the important scientific questions, and remember that the best applied research is research that is done in a basic manner.

Smith: I represent a provincially owned R & D company with a mandate of self-sufficiency, including support of substantial inhouse R & D activity, so I'll attempt to represent the views of the local high technology industries and to give perhaps an additional perspective to my copanelists' views on the White Paper.

I have viewed the publication as perhaps the government's view to having a science policy to develop much more that just science technology. I mean, what's the point of a science policy if it doesn't lead to future industrial, social and economic development in the province. So I intend to look at it from that perspective rather than an academic perspective.

As far as I can see, the White Paper is an excellent policy statement. It's based on solid review cumulating in what I believe is an appropriate policy for Newfoundland. Unfortunately, as is always the case, equally so for high technology companies and universities as well as other research institutions when you have discussions and policies on support funding, it's always too late (1).

I should hasten to add, however, in support, that the Newfoundland government, with its limited fiscal resources, has always recognized the necessity for a viable R & D base in the province as is clearly demonstrated by its founding and ongoing support of various departments at Memorial, including C-CORE, as well as agencies like ourselves. The identification of fishery, forestry and energy resources as the centre for the main thrust of the science policy is obvious to me and naturally fits the Newfoundland sphere of interest and capability.

Such an identification of areas leads to the next recommendation of (2) placing priority for the immediate future on the development of marine sciences as they relate to the Newfoundland socioeconomic environment. The Newfoundland people have learnt to coexist with, and harvest from, our ice-infested waters for over two centuries.

So it is natural to combine this heritage with the new sciences to tackle many of our offshore challenges.

I believe the proposed strategy of (3) "leap frog" technology to help the short-term development does have merit, but I also have some strong reservations. NORDCO is going through this phase now. We have very limited funding and we're approaching or attempting an equivalent of leap frog technology to bring in revenues to put back into R & D. My only concern with this approach is that I believe it really rests in the manufacturing sector and not in the R & D based area, which is implied in the policy. However, because we have such a small manufacturing infrastructure in Newfoundland, the local R & D based organizations must take the lead role. But I think we must recognize the danger of such a leap frog technological movement because, as we are finding, an organization could easily lose momentum in the more basic research and applied sciences. Because you're so engrossed in developing other peoples' technologies and adapting them to your own environment, you're losing that innovative approach to the basic development of pure science as applied in this region. I believe that there are a lot of real future innovative approaches that we can and should develop within the province.

The proposal to form a (4) Newfoundland Science Council provide guidance and advice to the provincial government deserves serious consideration. I am very positive about such a body being created, provided it's in the Newfoundland context and that it does not (5) become a heavily institutionalized council but remains as an advisory body providing broad scientific guidance to the government.

(6) From the point of view of the local high tech companies, funding for R & D is our major concern. The White Paper discusses the federal goal of 1.5% of the Gross National Product and the provincial goal of 1.5% for R & D support. We can only fully endorse that proposal.

(7) However, when I look at all our potential resource-related projects and the likely rate of development over the next decade as outlined in several megaproject studies emanating from Ottawa, I can only conclude that the overall proposed increase in funding is still totally inadequate, especially if we as a country wish to have our scientific, engineering and manufacturing companies take a lead role in the development, manufacture and implementation of new innovative approaches to bring these enormously varied resource projects on stream successfully.

(8) I believe the White Paper did not address, or at least did not address clearly, a major problem facing all high technology organizations attempting activities in the marine sciences in Newfoundland, namely, the almost non-existent manufacturing infrastructure, with the obvious exception of the fish processing industry. This lack of such a manufacturing intrastructure tends to place high technology R & D based organizations at a disadvantage when seeking federal R & D funds, since most of the programs are directed to assisting manufacturers to develop new products. Consequently, the level of funding, with the exception of one or two excellent National Research Council programs, is usually restricted to basic labor cost, as the funding agency presupposes that the company seeking assistance either directly or in conjunction with research institutes has a product-based cashflow sufficient to absorb the overheads and other support costs of the R & D activity. While this may be true in Ontario, Quebec, B.C., and even Alberta, it certainly is not the case in Newfoundland, where we appear to be in the middle of a classic chicken and egg situation. That is, the only organizations with the capability to act as catalysts for the development of relevant Newfoundland-based innovative ocean-related products are the

research-based institutions and organizations. From the point of view of these organizations, I firmly believe that we will be able to meet the province's aspirations for genuinely Newfoundland-based marine science secondary industry in the coming decade. Concepts and products emanating from these organizations would help develop a strong secondary industrial infrastructure specializing in the related marine science activities. Once the infrastructure is in place, I believe it can be self-sustaining in terms of new product development.

Unfortunately, these organizations are not in the manufacturing area nor as yet have they grown to such a size as to have sufficient product cashflow to take advantage of the range of excellent federal support programs available. (9) This is where I see a gap in the stated policy in that it does not come to grips with the somewhat unique problem faced by the Atlantic high technology companies. This shortage of available funds has to be alleviated if Newfoundland is to have a R & D sector capable of becoming the catalysts for secondary manufacturing and services.

(10) My proposal is to piggyback provincial funds on suitable projects already partially funded by federal programs to make the overall development viable for the local R & D based organizations.

In conclusion, I believe the White Paper to be basically sound in the choice of scientific direction and appropriate for the Newfoundland potential development areas. I also believe further refinements in the funding support for locally based high tech organizations is mandatory if the policy is to succeed. Finally, I also believe it has not really, to date, recognized what we hope to consider in terms of the optimum methods of dispensing and controlling future R & D funds hopefully available under any future offshore regulatory agreements.

Dempster: I think it's important for the audience to remember that this is a discussion, not a lecture by the panelists or a debate between us. The panelists are now willing to answer questions to begin the discussion, but it may be that, when someone raises a point in the audience, someone else may have a burning desire to answer it. Is there anyone who would like to start things moving?

Question for Mr. Smith: Early in your remarks, you said re: this White Paper forecasting some increased provincial support for R & D activities is as often always too late. Were you thinking of some particular ways in recent years that Newfoundland has already missed the boat?

Smith: Well, I think an example is NORDCO, which was founded in 1975, with a specific mandate of assisting, being a catalyst if you like, in the development of ocean resources technologies. The whole mandate is strictly ocean resources, which fits the White Paper.

I believe that, because of federal/provincial problems with DREE funding and R & D funding, we have not really met our mandate in the R & D sense. We've had to become more of a conventional service company/consulting company to generate revenues to do the little R & D that we are undertaking. Unfortunately, a lot of the work we're doing now is not in the public domain. We undertake R & D for clients where it's specifically client confidential.

Question: A few people have made the comment that they're in support of the Science Council, but they're not saying how they see such a council functioning. I am just wondering if some of the participants and some of the panelists might express their comments on how they see such a council functioning.

Answer (Niall Gogan): The proposal for a Newfoundland Science Council seems to indicate that it should be an advisory

body. I think the government should seek advice broadly from the community at large. A Science Council would be a formal mechanism for doing that so, as such, I think that would be very useful in determining the future direction of provincial science and technology funding. I think quite a small council, with about nine to eleven people, should be adequate to represent various sectors of the Newfoundland society. It would advise government, presumably through some central agency or perhaps through various departments. The focus would be on development but I'd like to say a few words to you later on the distinction between science and technology for development. A science policy for development and an overall science policy may be two different things.

Dempster: I know that people have expressed concerns to me that the concept would be moving to a centralized kind of body and, if everything were OK, the council would function remarkably well. If, however, things weren't too good because you put all your eggs in one basket, then the science policy would go down the drain. These are two points of view that have been expressed in the community.

Comment by Ivan Palmer: I should say, perhaps, by way of a bit of background, that legislation was passed in 1961 to set up a Newfoundland Research Council. It may be that the thinking expressed in this White Paper is a derivative of that. Since government's interest in science is to further economic development, I suggest that one form of Science Council that might be appealing in certain quarters would be to get good representation from different regions of the province as well as concerned business and even manufacturing people but no scientists at all to advise on the directions that, particularly, applied science should go, in order to introduce some objectivity into the proceedings and avoid the self-seeking of the scientific community.

Comment from the audience: Yes, that's an interesting thought, but I would like to imagine that it might be carried through perhaps to the makeup of the Treasury Board, where we could perhaps have no economists, accountants, or financial advisors whatsoever but a lot of ordinary people to tell us exactly how we should handle our money. With regard to the structure, I like the concept presented by Niall Gogan of a modest Science Council linked directly to the Cabinet. Niall also suggested that it should be advisory, and I agree. I anticipate that it would need to work through a series of working groups or committees. I would hesitate to suggest a structure with regional representation just for the sake of regional representation.

Question: I have two questions: (1) Should this council allocate the money? (2) Where should it get the money?

Dempster: Yes, I think that's a key issue. Advisory councils commonly go through a period when they give advice and, when they don't see any action being taken, they become frustrated and almost always then start asking "What exactly should we be doing?" and they want to move from being advisory to wanting to take on the role of telling what should be done. In Norway, the NTNF, the Royal Norwegian Research Council, actually develops and advises the government on policy. Government can either accept it or reject it. If government accepts it, it votes money, which is then placed under the control of the NTNF.

Another comment: My feeling is that, in the Newfoundland case, a council would not be handling money but would be mainly advisory. We don't want to create another body in competition with existing organizations, either in government or private enterprise or whatever. It should be strictly advisory on a broad range of scientific goals, not analyzing each individual project

and whether it should be financed or not.

Question: Would a council of this nature have some kind of support staff?

Answer: I envisage maybe an executive director only. You need someone as a focal point but one of my biggest worries is that we don't seem to be very innovative; we seem to be always piggybacking on other people's technologies. We're very good at applying other people's innovations in electronics, especially in communications, but we're weak in pure basic innovation. I hope the Science Council would give guidance in this area rather than determine research funding.

Question by Ivan Palmer: Does that mean that you disagree with this statement that we shouldn't muck around trying to be original, that we should be doing new projects?

Answer: Yes, I do. Well, I think that in the short term we have to recognize the dangers of it.

Question: In reading the White Paper and hearing the discussions this morning, I have the impression that there is a need for a new structure such as a Science Council, but I'm wondering if there is any "real" need for such a council. Would it not be adequate to just have a science advisor to the government rather than a structure like a council?

Answer: That's a very interesting point. I'm sure the Memorial people would say yes, they would look after your R & D. Frank, of course, I'm sure would disagree.

Question by Ivan Palmer: How do you tap Federal programs in a coordinated way? How do you ensure that local companies get their share of federal R & D funding? Who is doing that now, Mr. Chairman? There must be some lobbying that goes on now.

Answer: There's no overall coordination for the province. Everybody rushes up to Ottawa in competition, in a sense.

Comment by Ivan Palmer: I think that is a very important point because, while in marketing we accept the concept of segmentation marketing, in R & D, we simply lump everything together. One of the things I've often thought about is that perhaps the provincial government should be aiming at a particular segment of applied R & D which is directed towards economic and industrial development. It's that segment which in this province, I believe, is now uncoordinated and disorganized. Because of that, we are losing out on opportunities for funding. The other segment, which we may loosely call basic research, is generally covered within Memorial, which is better organized and more coordinated in its search for funding and, relatively speaking, it gets well funded for that sector. It's the other part, the applied research, that is really not organized in this province. Frank taps some sources and other organizations, for example, C-CORE, tap some. The local companies also try to tap some so that what happens is that Newfoundland organizations are actually competing with each other. They go up to Ottawa and compete when we ought to be coordinating our efforts.

Panel #2: Experiences of other provinces

Chairman:	Dr. W. Russell, Newfoundland Petroleum Directorate
Panelists:	Dr. G. Trick, Manitoba Research Council
	Mr. J. Fitzgerald, Intergovernmental Affairs, Newfoundland
	Mr. P. Dufour, Science Council of Canada
	Dr. P. Lewell, Research and Productivity Council, New Brunswick

Russell: I would like to explain briefly what we will do in this session. First, Dr. Trick will give a presentation and we'll have a short question period specifically related to his talk. After that, I will introduce the remaining members of the panel and have each of them give a short statement on the subject of this session. Then, we will open the floor to questions. The objective of this session is to look at experiences of other provinces to see how relevant those experiences are to our situation in Newfoundland, specifically, the experiences the provinces with similar problems have had in setting up a PRO or Science Council or the like. I would now like to introduce Dr. Gordon Trick. Dr. Trick is the Executive Director of the Manitoba Research Council and Director of the Technology Branch of Economic Development and Tourism. Dr. Trick's education is varied. He received a B.Sc. from McGill in the 1940's, a Master's degree from a University in Ontario, and a Ph.D. from McGill. He did postdoctoral research at King's College in London. Dr. Trick has worked at the Defence Research Board of Canada, Goodyear Tire and Rubber Company in Akron, Ohio, and, from 1971 to present, with the Province of Manitoba. He has published extensively and has been invited to lecture on many items, including technological innovation, alternate energy, science policy and economic development. Dr. Trick's talk will be on Manitoba's experiences contrasted to other provincial research organizations.

Trick: Thank you, Mr. Chairman. I have been asked to speak to you because we are the newest and youngest of the provincial research organizations. Our Act was passed in 1963 but we did not become operational in a true sense until about two years ago.

I will try to keep my comments brief and I hope they will be useful. I hope that I can bring you some new concepts, some ideas that I think are timely, and which have arisen from my experiences in industrial research as well as with the Manitoba Research Council (MRC). First, I must tell you where MRC is today and where Manitoba is today because those two have a close connection. In essence, MRC is the technical arm to help to implement various phases of an industrial development strategy in Manitoba. The total strategy involves the value added of our natural resources combined with broader based secondary manufacturing activities. Our resources in Manitoba, as we can utilize them, are not sufficient to sustain our population of about 1 million.

MRC has two laboratories, one in Winnipeg and one in Portage La Prairie, 100 km to the west of Winnipeg. They are both located in small industrial parks. The total staff is about 40, a quite modest size. 25% of our gross revenue is from contract research in the private sector; the rest is from the provincial government, not as a grant, but conveyed by a contract for services between MRC and the province so that MRC will deliver certain services at no cost to Manitoba industry. I will emphasize some of the characteristics that I feel are important. We do not want to receive grants from anybody, including the government. We want a contract to deliver a service for the government or whoever else may be our client.

MRC only became operational when the laboratories officially opened in June of 1980. Our mechanism of reporting is to the Minister of Economic Development and Tourism. Our council is the Board of Directors of MRC. I am the Chief Executive Officer and the Board of Directors has 10 members, only one of whom is from the government. There is no definition in our Act of what type of people will be on council but there are one from government, two from our universities and seven from the private sector.

I consider MRC to be at the first plateau of a growth pattern and that plateau will probably continue for another two years. Reaching our present

level of activity has not been easy. For several years, MRC sought to accomplish its mandate by financial support for existing organizations and people in the province. The benefits were limited but the experience clearly demonstrated a deficiency in Manitoba, a deficiency oriented to the practice of technology by our secondary manufacturing, a practice of problem solving to obtain quick answers.

We are now placing our priorities basically on the total utilization of science and technology in an industrial environment. Now let me demonstrate this.

The characteristics of Manitoba in employment are as follows: agriculture employs 44,000 people, other primary industries 7,000, secondary manufacturing 64,000. Manufacturing is a bigger employer than all our primary industries. We have 1600 manufacturing firms, with the largest being the food and beverage industry, then machinery, metal fabrication, transportation equipment and clothing. It is important for me to bring that perspective because it affects what we are doing. By far the largest part of this activity, about 80%, takes place in Winnipeg.

We have done extensive analysis of the various parameters of technical and scientific activity in Manitoba. There are problems in getting accurate data but, basically, Manitoba has a reasonable level of scientific activity in its universities and in its Federal laboratories. However, it has a severe deficiency in the kind of activity that's called industrial research, or the kind of activity that we call technology. That's where we have a serious problem.

I would like to point out certain peculiar or particular characteristics of MRC. Our laboratories are almost totally oriented towards secondary manufacturing. We also have some activities in alternate fuels. We are the technical arm of the Manitoba Department of Energy. We are not active at this time in primary industries, in environment and other areas. There are two reasons for this. First, the biggest and most immediate benefits from our activity arise from the support of secondary manufacturing, particularly in terms of meeting the employment needs of the people of Manitoba. Second, many of the activities related to primary industries and to the environment are already being carried out by, or are the mandates of, other arms of the government.

Our laboratories concentrate on technical knowledge, information and assistance, raw material and product evaluation, quality management, manufacturing productivity, prototype and product development, and co-ordination with the National Research Council of Canada (NRC). We have a different kind of working relationship between MRC and the NRC whereby we are trying some new systems to try to bring the skills of the NRC to bear on Manitoba. We have no significant NRC activity in Manitoba in the laboratory sense.

Another important characteristic or purpose of our lab is to simply demonstrate what technology is all about. To many of you, this may seem self-evident, but it really isn't. We had a market survey done last spring. We knew that if we talked about the sciences, about research, we would turn people off. I am talking about the general public not our clients. We found that the word technology would even turn them off. We don't know where to go now but that's the business we are in. We are trying to show people, government and industry what technology is all about.

I would like to make a few comments now on our concentration on productivity, because that is our highest priority. Certainly, in Manitoba, and maybe nationally, it has not been

recognized well enough. I think that too much emphasis is placed on product development, on the invention of better mouse traps. The problem is really the conversion of these products into something that you can make and sell, and I think that's a real problem.

There are really two deficiences in Manitoba. (1) One is the ability to marshall its productive capacity to manufacture the products, meeting required costs and performance, together with the ability to get out and hustle in the market place. That may seem self-evident but I think that it is a severe stumbling block in Manitoba and in Canada. There are any number of wonderful prototypes but, when companies need to mass produce, their ability to gear up their production capacity presents real problems. (2) The other deficiency is in the ability of management to cope with the uncertainties of technology, to manage the imponderable, to manage the unknown. Models to follow are not evident since managing a technology company is much different from setting up a grocery store, though they both require a lot of dedication and skills. If you want to see how to run a grocery store, you have a lot of models around town. The technology-based company is quite different. They are all different. That's why our major emphasis is on productivity and technological management and why, as another of our roles, the Manitoba Research Council is heavily involved in trying to bring to Manitoba the National Research Council Laboratory dedicated to the technology and the science that relate to the manufacturing process itself.

Our policy is to work in concert with the existing skills and existing organizations. We don't have a high level of activity in microelectronics within the MRC lab. There is a private sector organization at the University of Manitoba called the Industrial Applications of Microelectronics Centre. Instead of developing a competitive or duplicate skill, we decided they would be our microelectronics arm. They were growing as we were. We have supported them for three years at $300,000 a year. If we want help in microelectronics or microprocessing, we go to those people. If our client needs courses to bring him up-to-date in microelectronics, that group gives them on our behalf.

There is a similar situation in the area of biotechnology. MRC will have very little of its own activity but will contract out to the University of Manitoba. Another case is high voltage dc transmission. An organization in Manitoba that is just getting started is dedicated to that subject so we will not compete with it or duplicate it; instead, we will work with it.

MRC has three main components. (1) It is a contract research organization. (2) It's an industrial development organization. (3) It's an advisor to government. No other agency fulfills these roles in Manitoba. We don't have a science council as such. For a couple of years around 1965, the Premier had a Science Advisor but that was for a short period only.

What is my perspective of what we are trying to do? We are not trying to establish a technological industrial base but we are trying to strengthen our present base with the use of technology. Take the clothing industry. Perhaps you don't think that is a technology based industry. It doesn't do a lot of research but I'll assure you that, if you go into a modern garment factory, you will see technology used to absolute limits. The importance of the reduction in wastage, the importance of technology related to productivity, the dollar value in that competitive field is tremendous.

What MRC is doing at this stage isn't exotic, isn't high profile. We've kept a low profile. After two years, we do not even have a brochure to hand to people saying what we do. We haven't had time.

People have said that I lack imagination by not going into more exotic things. I can't disagree with that except in terms of the time frame. We are trying to get the most immediate results that we can. I would like to point out also the importance of working with government. Our organization is supported by the Manitoba Department of Economic Development and Tourism, by DREE, by Industry Trade and Commerce Canada, by the National Research Council and many other organizations and people who have helped us financially as well as with their skills.

It is important to get a commitment from these partners. Something is going to happen. It is not all going to happen at once but it is going to happen. It has been a lack of commitment that has caused Manitoba to be so late in getting organized, in getting into some kind of technical activities similar to many other provinces.

I have tried to describe MRC in the Manitoba situation. This may have little or no relation to Newfoundland. The Science Policy will come up tomorrow in the terms of the White Paper. I am certainly happy to take part in this discussion this morning and I think that by noon tomorrow the Newfoundland government will know better where they want to go and the way they would like to proceed.

Question: Dr. Trick, you indicated earlier in your presentation that one of the objectives of your institution was to improve the productivity of the existing industrial agencies in your province. How was that particular question decided and by whom?

Trick: I wish that I could answer that with great brilliance and the law of deduction. Rather, it was a seat of the pants kind of thing that was decided three years ago. We didn't make a major decision at the time, but the passage of time has reinforced the validity of our decision.

Comm : It was evolutionary then.

Trick That's correct.

Question by Ivan Palmer: Gordon. There was quite a bit of talk at lunch time and over the morning referring to (1) our own position to lobby for funds from the federal government, (2) the need to coordinate the efforts of the different R & D organizations that already exist in Newfoundland, (3) the need to advise on priorities the government should support in R & D. Who in Manitoba does all those things while you are running your service shop?

Trick: I would say that it is probably done by two or three people, as best we can. No more than that. There is no real organization. Basically, between myself and the Department of Economic Development and Tourism. Our laboratories are managed by Directors and they tell me at the end of each month what the balance sheet is. I leave it up to them. The priority that I have is looking at next year and the years ahead, to lobby with Ottawa to decide on new activities, and I should say that we see a number of pinacles of excellence. We may not do any of them but we probably will do the one on productivity. The others will probably be done by other people.

Question: I had a question on the transfer mechanisms. How do you get the results of the R & D that you do out to private industry?

Trick: Well, I guess I should say that we really don't do any research. We have some small in-house programs and all I can say is that we find customers or a group of customers for that technology at the very earliest moment. The idea of great ideas coming out of the back door of the lab being soaked up by industry is not happening and will not happen anywhere. Get the industry in there on day one if you can. Then you can follow the best possible path. Otherwise, you will be making a square golfball and industry wants an oval one.

Question: Who decides what programs you work on?

Trick: Demand from the public as much as anything. I did not anticipate the tremendous demands upon us for the testing of products or raw materials. That level of activity is probably three times what we envisaged.

Question: You mentioned that the Act was passed in 1963 but the council only got going two years ago. What caused the sudden interest in resurrecting the Act and getting it implemented?

Trick: All I can really say is that in 1969 the New Democratic Party got elected in Manitoba and, being totally new to government, they asked a lot of people what kinds of new initiatives could take place. One of the suggestions was to resurrect the struggling Board of Directors of MRC. The next step was by a Conservative Government that organized federal/provincial cost-sharing of our programs. That was the key - it's a window that opens every now and then and if you don't grab that window when it opens it will be locked for another ten years.

Question: Is there anything that your council could do over the long term to help the majority of workers in your province to be more productive?

Trick: We could work more closely with the service industries. We've got 133,000 people working in service industries and I sometimes feel Manitoba or any province doesn't have to produce a piece of mass-produced hardware ever. We should concentrate on software - brain power.

John Fitzgerald: (Assistant Deputy Minister of Intergovernmental Affairs in the Province of Newfoundland.) By way of introducing my few comments, I would like to say that I'm not engaged directly in the scientific community in the course of my normal work. I became involved in this subject when we were reviewing an application which had come to our central offices for funding support for one of the institutions here in the province which is engaged in scientific activity. At that time, somebody noted that this was just one of a number of such applications which had come to government in the past little while looking for significant amounts of money. The observation was made that we didn't seem to have any formal mechanism within government to evaluate these various applications. So it was decided, sort of on the spur of the moment, that we would suggest to Cabinet that we should (1) obtain an overall view of what's going on in the province, (2) do a survey of the resources available for R & D and related support activities of various line departments, and (3) perhaps coordinate better their activities with the research establishments already available in the province. Indeed, we must try to coordinate our activities with activities of the federal government in the province as well as with research activities done within Memorial University and the other research centers here. So we began a survey to see just exactly what was going on. The conclusion from that survey was that there is no overall coordination within the provincial government in any kind of disciplined way to allocate such funds that it does have available. There is no formal mechanism within government to allocate the total research budget of the province in any kind of formal way.

We did look around and we found that, at Memorial University, as Dr. Trick has observed, there's a volume of research being done, never sufficiently funded in the view of the university, of course, which seems to be consistent with the population, probably largely supported from the granting agencies but somewhat from the private sector. Within the provincial government, we spent in the last year for which I have figures for R & D and various kinds of technology demonstration projects something in the vicinity of $6.5

million. Quite a substantial sum of money for a province our size. Those funding levels, while surprising when we looked at them, were possible, and we must acknowledge this, because we have had in place a number of federal/provincial agreements with research or demonstration proponents associated with them, which enabled us to lever the provicial expenditures using the higher percentage of federal expenditures to convince our political masters that these were good and valuable things to do. At the same time, the government was coming to the view that, if we were to address the very substantial problem of finding employment for our people, we would have to do something about making our traditional industries more competitive, to diversify them, and at the same time to introduce some new opportunities into the economy. The presence of exploration activity for oil and gas, and our enacting of associated regulations containing a requirement for the involved companies to make some expenditures for R & D related to their land holdings, has been a big factor. It became apparent to government that it should be possible to do some of the things we had not been able to do before. Perhaps we should create a fund which could be made available for contracting for research and activities of a development nature which could conceivably result in some spinoff activities. That part of the exercise is what gives rise to the publishing of the paper "Towards a Science Policy....", which has given rise to this meeting.

Within the province now, there is a considerable reservoir of trained people but there is not, in government's perception, a sufficiently disciplined coordination of those resources, nor is there sufficient dialog between those conducting research at the front end, at the leading edge of science, and those who are required to take that research and transform it into commercial opportunities and to improve the technological performance of our industrial enterprises.

Our main industries, of course, are very heavily resource oriented. The present research in those fields tends to be done outside the province by the manufacturers and there is virtually no mechanism for improving technology transfer to the existing enterprises in the resource field. There have been demonstrations on an ad hoc basis as individual departments have recognized deficiencies. Some of these have been addressed; some have not.

Our basic problem is funding and will continue to be funding for some time. I'm sorry, but that's the way it is. Those of you from Memorial University might have been looking to this exercise as a notice that there would be more funds for R & D but that is not likely to be the case in the short term. With some luck, if our aspirations offshore are realized, we will have more funding in the long term.

For the short term, the province has indicated that it will be focusing its resources towards the enhancement of the traditional industries and the productivity of those industries and seeking new opportunities within them. It will be using new avenues to try to create activity related to resources which will, in the long term, give rise to some industries which are not now in existence.

Paul Dufour: Paul is a graduate of the Institute of History of Science and Science Policy (Institut d'Histoire et de Sociopolitique des Sciences) at the University of Montreal. He is producing a report on "University-Industry Interaction Across Canada" and is presently involved with the study of the provincial research organizations with one of his colleagues, Dr. Donald Le Roy. Mr. Dufour has been with the Science Council of Canada since 1979.

Dufour: I would like first to thank Ivan Palmer and the Department of Development for having us come here. Personally and on behalf of the Science Council, we

certainly appreciate being invited. A new initiative has been put forward by the Government of Newfoundland and Labrador, and I am pleased to be able to participate.

I have tried to bring a perspective of initiatives that have recently taken place in provinces other than those already represented by the panel this afternoon. As such, I will comment on developments in British Columbia, Alberta and Quebec which might help catalyze the discussion later.

One of the benefits of working with the Science Council of Canada is that it is a national Crown Corporation. This gives one an opportunity to develop a national perspective. The Science Council is presently involved in studies that relate to science policy in the provinces. I have been involved with a study on industry and university interaction across Canada. We are looking at several case studies which are interesting models of interaction between the university and industry sectors. One case study focuses on Saskatoon's research complex in food processing and related areas. In St. John's, we have looked at the developments around C-CORE, the Arctic Vessel and Marine Research Institute, NICOS and all other Memorial University expertise in the cold ocean sciences area and their link to the industrial sector as well, of course, as the spinoff companies that have emerged from C-CORE, such as Instrumar and Remotec.

Another study that is now underway centres on provincial research organizations. This study is of a short-term nature, and we hope to have a paper out on the subject soon. We are focusing on the eight existing provincial research organizations and are particularly interested in, not only the PRO's themselves, but also the contexts in which they have evolved: these are just as critical and just as important to understand as the mechanism itself.

One of the small myths that has been mentioned this morning is that there has been very little tradition in Canada of fostering industry-university-government research links. I think that as one looks at the developmental history of the sectoral isolation which to some extent does exist, and has existed over the years, one can see that there are several examples which could be very useful models for interaction and cooperation. One example is the Pulp and Paper Institute of Canada, which was set up very soon after World War I on the University of McGill campus as an initiative of the federal government and the industrial sector.

I say this by way of introduction, perhaps, to a phenomenon that has been going on very recently, which has become much more visible. This is a trend to institution building in various provinces. British Columbia, for instance, has over the last 6 or 7 years developed an industrial and economic strategy to foster its scientific and technical expertise. It has been largely the work of one man who has been the progenitor of a lot of initiatives, Patrick McGeer, the Minister of Universities, Science and Communications. British Columbia has created a Science Council which both grants money and provides advice to the provincial government, as contrasted to the Science Council of Canada, for example, which does not fund research. There has also been the initiative to set up what McGeer calls Discovery Parks, designed to attract high-technology firms to British Columbia. I believe there are four being established in the higher education institutions of British Columbia.

Another interesting development has occurred in Alberta. Although there has been no explicit science policy strategy for Alberta, there have been several initiatives over the last decade to promote industry-university-government interactions. These have been focused primarily in the Alberta Research

Council, one of the most closely linked to the Cabinet of all the provincial research organizations. The President of the Alberta Research Council, Gilles Cloutier, is a Science Advisor to the Government through the Research and Science Advisory Committee. Another interesting development there has been the Alberta Oil Sands Technology and Research Authority, which has been established by the provincial government to foster oil-related research.

The Quebec scene has been a very exciting one as a very organized and planned discussion focusing around science policy has developed. It has been a grass-roots approach, a democratic approach, in which several sectors were consulted for input on the science policy to be implemented in Quebec. Over the last year, a Ministry of State for Cultural and Scientific Development was created, much along the lines of the Ministry of State for Science and Technology at the federal level. Quebec has attached to that a Bureau of Science and Technology which functions essentially as the Secretariat to the Ministry. They also have a Science Council, a public body composed of people from various sectors. The Council has its meetings open to the public, an interesting invention in that the public can discuss and approach issues relating to the development of science and technology in Quebec.

Basically, what I have done very briefly has been to give a broad review of what's going on in some other provinces. I think this is a useful approach, and we can learn from the experiences elsewhere. However, I would caution about applying a direct model approach from other PRO's to Newfoundland. One must be very cautious about it and be aware of the possible pitfalls that evolve in developing science policy copied after developments in some other province.

Peter Lewell is Assistant Director (Executive) of the Research and Productivity Council (RPC) and Head of the Industries Department for the Province of New Brunswick. He's a native of Saint John. He has a doctorate from the University of Cambridge. He joined the RPC as a Project Engineer specializing in food processing in 1969. He became Head of the Management Service Department in 1975. He has done R & D projects on behalf of manufacturing companies as well as a number of policy studies for provincial and federal governments concerning R & D subjects. He has had assignments in Southeast Asia and in Latin America.

Lewell: I was interested to learn this morning that Newfoundland has a Research Council Act dating since 1961. There must have been a sale on these at the time because that is when our Act was put together to establish a Research and Productivity Council. Rather than being allowed to slip quietly into oblivion, our Act was picked up by some university and industry people in New Brunswick at the time and was used as a basis to form an organization. First, the bricks and mortar went in; then, the search for programs. In an initial 5-year plan, provincial government funding was to increase to $600,000 per year by the fifth year. Part of our funding (about 15%) was to come from contracts, which depends on the skill that our people have at any particular time in tapping the contract research market. Probably the two most significant things that we have done in R & D have fallen out of the DREE Sub-Agreement which existed until the 70's. We had one on minerals which provided R & D funding for some process development work related to the metal ores in New Brunswick and one on forestry which provided funding for us to get rather specialized in the whole area of insect protection or, rather, protection of the tree against the insect.

The problem for me in addressing this group on this subject arises when you attempt to focus on R & D as a mechanism for industrial growth as a

provincial development strategy. You will find, at least from our experiences in a province like yourself, that an organization such as ours is far too concerned with the struggle to survive month by month, year by year, to be really outstandingly effective in serving a broader provincial mandate in industrial development to the application of R & D. It really comes down to this, that you can't be developing new technology and employing and training local technical people in the process, and profiting from the successful application of that technology at the same time. What I am saying is that, if you have to derive your income to survive as an organization, from profiting from your technology, you never have time to develop your technology. In other words, the funding comes first. If you assume that the province is going to invest or increase its R & D expenditures, as is being contemplated for Newfouundland, but unhappily not for New Brunswick yet, the question of interest to me is, how do you allocate those expenditures? How do you allocate new provincial R & D expenditures so as to accomplish its strategic development and manpower objectives while involving a provincial research organization in the process?

I don't have any answers but I have a few comments. If the opportunity were presented to me in New Brunswick to advise our provincial government on how we could use $2 million per year of industrial investment in R & D, a couple of things would come to mind. First, I would try to piggyback on existing federal programs wherever possible. I think that those in place now for encouraging R & D are excellent. Our problem is that we don't have the private sector entrepreneural talent in our province to pick these up and to exploit them in the same capacity as Ontario or Quebec, for example. So, I would try to develop a provincial mechanism to overcome some of our inherent handicap and get on the with job of using the R & D incentives that the federal government has made available. One example is the Industrial Research (IRAP) program which the National Research Council has, and has greatly expanded recently. This year, probably about $250,000 will go into small firms in New Brunswick which are doing R & D projects in the order of about $30,000 each. Paradoxically, we have a contract from NRC to provide some human resources, some people, to sell these programs to New Brunswick industry, to talk to them about using these programs, and to help them to define their projects. The terms of the program are such that the money goes to pay only the salary costs of the company's researcher who is doing the work. Therefore, that money is not available to new outside R & D talent, for example, people who will be at our place to do the work. This is fine if the company has an R & D department but, as in Newfoundland, not many companies in New Brunswick have any R & D capacity or any technical people. So I wonder how well these $30,000 projects will be done and how effective they will be. In a way, though, we are doing an experiment. My point is, don't change the IRAP program because it's an excellent program, but perhaps we can come up with some provincial initiatives that would reinforce the capacity of our companies to use the IRAP program, given the restraints that are on it.

Another suggestion that I have is, don't shy away from large scale provincial initiatives in specific core-funded R & D programs. If the province has money to spend on large scale, provincial priority, R & D projects, it needs cooperation and confidence between involved government departments and the provincial research organizations. That probably means surrendering a little bit of independence on each side, and maybe giving up some of the emphasis on related scientific activity (RSA), i.e. activity which returns over the short term, and taking on the liability of attempting to

do something rather significant on a larger scale. It is as much a gamble for a PRO in some cases as it would be for the government departments concerned.

Finally, any province should try to come up with some mechanism for technology transfer to the private sector to pick up the manufacturing opportunities which might develop. Again, the NRC has an excellent program, the PILP program, where they do this on a national basis. The capacity for New Brunswick and Newfoundland to respond to the PILP program is less than that of a province where there are a large number of manufacturers who are into technology. So, again, try to piggyback on that. Try to come up with a provincial initiative which would plug into PILP and help your companies either to use the PILP program or use a comparable program that might be applicable at the provincial level for provincially developed technology.

In New Brunswick, we are now trying to get some discussion going on these bigger issues. We have not yet reached the point of considering a science policy but I suspect that, before the year is out, we might be.

Tom Pepper was raised on a farm near Morse, Saskatchewan. He has a Ph.D. in Nuclear Physics from McGill. He worked for five years at the Atomic Energy of Canada at Chaulk River, spent five years in the private sector, as part owner of a firm making measuring and control instruments using radioactive isotopes. For the last twenty-three years, Dr. Pepper has been with the Saskatchewan Research Council, including the last ten years as Chief Executive Officer.

Pepper: The Saskatchewan Research Council Act was enacted in 1947. For 10 years, the Saskatchewan Research Council was a granting agency only, to stimulate university research. In 1957, the Research Council adopted a new Terms of Reference and became a dual-agency and, for the last 24 years, we have been conducting TIE. Rather than use the term Research and Development, I use TIE (Technology Implemented Effectively). Technology is no good, in my view, unless it is implemented effectively. We have been engaged in applied technology for 23 years and we are now spending about $10 million a year. 30% of that comes from government as a grant, and we decide how to use it reasonably effectively. $7 million comes as a fee for service work.

Our program runs roughly like this. We ask a question: "What does nature provide in Saskatchewan that can benefit from the application of technology?" This leads to our resources development programs. Then we ask: "What do people do that can also benefit from TIE?" and we come up broadly with the industrial programs. And then we ask: "What have both of those activities done to foul up the environment and make life tougher?" and we decide that we must have an environmental program. Finally, we have a whole lot of services that feed those three programs. Roughly, that is what our program is. We are also undergoing a Long Range Plan of revising our set-up which I will be happy to try and answer questions on.

In addition, in Saskatchewan, we do have a Science Council separate entirely from the Saskatchewan Research Council. It is not very active and is being looked at by an advisor to the government on science and technology. He has prepared a report that he has tantalizingly shown me but, since he wouldn't even let me look at it, I can't report on it.

We also have a lot of Crown Corporations which are in some cases building their own research efforts. The Research Council has liaison and a sort of working relationship with the Crown Corporations.

There are various other incentives for research in Saskatchewan. All together, it is a kind of ad hoc

program, but we are now trying to streamline things, though not to constrain things adversely.

I have been involved with the Saskatchewan Research Council for 23 years and with the Science Council from its beginning, so I have some other details that I will be trying to fill in tomorrow.

Question for P. Lewell: Regarding the New Brunswick Productivity Council having started with bricks and mortar. Would he recommend that kind of start for Newfoundland?

Lewell: In our situation, there was, in the 60's, a tremendous desire to get something locked in because under ARDA there was an opportunity to get some capital funding and I think that to a certain extent that was the immediate objective. Get the plant established, get the $2 million invested. In hindsight, it would have been nice to have gotten programming locked in at the same time because, once we got our facilities and our equipment, the province created a whole department of government to do just what we were supposed to do. By that time, we had gone too far to be stopped. We had our facility and our people and the inclination was to try to survive. You don't go away at that stage; you don't slip quietly into the night. It resulted in overlapping,, friction and poor working relationships, etc., with the government department.

Question: In trying to get a message from this for a Newfoundland model, should we now attempt to establish a working Research Council or should we use groups that are already in existence?

Pepper: I think we have to be very sensitive to considering what we should do and what should be done by the private sector. There haven't been a lot of private companies based in Saskatchewan but as this changes we may very well have to carve off a piece of ourselves at SRC. In fact, we were approached a little while ago with the query: "If you are going to carve off this particular function, we are interested in thinking about it." That is the sort of thing that may actually happen. There is still very much indigenous R & D and what I call TIE capability in Saskatchewan. I really believe, from the morning's demonstration, that you have quite a lot of the resources here in Newfoundland that we don't have in Saskatchewan. However, it's a real management question and we have to find how to handle ourselves most effectively in that arena.

Question to Gordon Trick: What was the strong new effort with sharing programming with NRC?

Trick: We have NRC employees in our building working directly with us on a cooperative basis. They work on contracts for NRC and we provide free service for NRC. There is a mixture of this. We want that to evolve into those people becoming our linkage not just for the headquarters in Ottawa but the NRC labs, particularly in Ottawa and Saskatoon.

Question: How many people work on R & D activity in each of these provinces in government-sponsored research institutions?

New Brunswick: About 85 people in R & D positions.

Saskatchewan: Saskatchewan Research Council has about 250 people. Saskatchewan Power Corporation has about 50 people. The Potash Corporation of Saskatchewan has a mandate to spend up to 1.5 percent of its gross sales on R & D, which would allow it to spend up to $4-5 million per year. There are also others.

Panel # 3. The Federal Perspective

Chairman: Dr. P.J. Heald, Memorial University of Newfoundland, Dean of Science

Panelists: Ozzie Silverman, MOSST
Wm. Coderre, NRCC
Brian Holmes, Canada Industry, Trade & Commerce
Donald Le Roy, Science Council of Canada

Heald: It is extremely important that we get the federal perspective on provincial scientific R & D programs. What are the federal agencies' views on provincial governments supporting scientific research and development? How do they see the federal funding interacting with this? How do they see the interaction between provincial agencies and federal agencies in the same province? For example, here in Newfoundland, we have an extremely good federal fisheries laboratory and, yet, the primary objective of the proposed science council is in the development of marine sciences. Some form of interaction has to take place. I hope that these and similar questions will be addressed by the panelists.

Ozzie Silverman has been the Director in the Industry Branch of the Ministry of State for Science and Technology since 1977. Before then, he was in the Department of Industry, Trade and Commerce. Before then, he was with Pratt & Whitney in Montreal. He was educated at McGill, both for a Bachelor in Engineering and an MBA.

Silverman: I will start by giving you a historical overview of developments since 1978. That was a landmark year because in November of 1978 there was the first federal/provincial conference on industrial R & D. It was a Ministerial Conference. Since that time, there have been a number of parallel developments.

First, I will start with the conference. At the time, there was a discussion between the federal government and the provinces concerning the role of research and development in regional specialization and economic development, as well as the possible need for some kind of priority setting. At the conference, the provinces asked our Ministry to consult with them individually and come up with a plan of action.

We started that process in 1979 and carried it through until 1980, in cooperation with the National Research Council. We visited all of the provinces at least once, following which we decided to consult with the Atlantic Provinces more intensively. Indeed, by about the middle of 1980, we had developed a detailed plan of action for Atlantic Canada. It was focused on what might be called the research and development infrastructure - missing links. We made a number of recommendations to the government. Some action has already been taken. Many recommendations are still awaiting funding. One of the actions taken was that NRC in Halifax was designated as the federal government coordinator for coal R & D. Although it is probably not of direct interest to Newfoundland, it still is a signficant development because, before then, coal R & D in New Brunswick and Nova Scotia was rather unfocused. Since then, there has been an increase in the budget and manpower of NRC for that activity.

Another significant development arising from these consultations was the appointment of an Atlantic Canada regional director by NRC. Before then, there was no regional director for NRC in Atlantic Canada. This appointment, in effect, decentralized the NRC programs and made them more accessible. It also provides the opportunity for the provinces to have more input into NRC on the definition of its research projects and to provide advice on programs to support industry.

I'd like to share with you some of the general findings we came up with. They apply to all four provinces.

The first one is that, next to the federal government, the universities are the largest performers of R & D in Atlantic Canada. They perform (and this is for 1977) three times as much as industry. This is generally not the case elsewhere in Canada. In the western provinces as a whole, there is more or less a balance between industry and university research. Nowhere else is the ratio 3 to 1. The implication here is that more attention has to be paid to universities as centers of innovation of the Atlantic Provinces.

In 1977, Atlantic Canada preformed 1.2% of the total industrial R & D in Canada but contributed 4% to value added in manufacturing. So there is an underperformance in R & D. Why? One of the reasons is that there are roughly three classes of firms in Atlantic Canada, namely, (1) small, usually cash-poor companies that can't afford R & D; (2) large companies in traditional sectors, few of which perform R & D; and (3) large, more sophisticated industry mainly in the resource sector where the parent company may perform the R & D elsewhere.

Another key finding concerns the traditional attitudes towards the way things ought to be done.

In addition, there is a lack of models. By this, I mean models in entrepreneurship. A very important psychological factor in encouraging people to take risks is for them to see how other people have done it successfully.

Another key finding is that there was insufficient communications between governments, universities and agencies. In particular, it seems that, if regional economic goals can be enunciated quite specifically, these will be reflected in the R & D topics chosen, and would certainly identify where technology should be transferred. There has been progress. The Council of Maritime Premiers recently published a report of its Task Force. The Nova Scotia Task Force published its report last October, and indeed across the country, there has been a move to better define science and technology priorities.

Insofar as the Newfoundland White Paper is concerned, it seems to me that one way of looking at the task is in the context of a strategic plan for research and technology development. One could think in terms of the need to identify what can be called strategic technologies, that is, those that will be critical to the realization of the province's economic and industrial objectives. There are many reasons why you would want to do this. For example, you would what to do it so that the lack of the technology at some time in the future doesn't become a constraint to development. You don't want to be in the position five years from now of waking up and saying to yourselves, "if we had developed this years back we wouldn't be in this trouble now". That is a difficult thing to do, but that is strategic planning.

There is a role for a Science Council in doing this, but is has to fit Newfoundland's specific needs and care must be taken not to simply follow models elsewhere. Also, you should not lose sight of the potential for technology to improve productivity in those areas that are not now a high priority for R & D, but have an effect on the efficiency of the whole economy in the province. When I say "in those areas not now a high priority for R & D", I mean those outside the areas identified in the White Paper. There are numerous activities in the province, such as construction, which could probably benefit from new methods.

Here I want to add a thought of my own and that is that engineers are often

left out of the consultation process. They are not consulted very often and I think the engineering people, not only of Newfoundland but across Canada, are hidden assets. Engineers are probably the most important channels for the transfer of technology.

Finally, I wish to add something about the interaction between the Newfoundland and federal governments. (1) I will leave the thought that, as a resource, federal science activities in the provinces should be seen as more than simply their sum total. They can be modified to enhance their regional aspects. (2) As well, I think that there should be a conscious effort in the future to include technology considerations in the planning for whatever new regime of federal/provincial agreements may arise.

Coderre: (Executive Manager of the Industrial Development Branch of NRC.) I'm speaking on behalf of NRC to give you a federal perspective on provincial research organizations. It will be a personal view or, perhaps more broadly, the view of the industrial development office within NRC, but not necessarily the view of every scientist and analyst.

NRC is a big laboratory. That is probably what it is best known for. I am not sure if you realize how big. Approximately 3000 people are employed by NRC; 1000 professionals, 1000 technical people and 1000 support people in eleven disciplinary divisions. Most of these people live in Ottawa but NRC has laboratories in Vancouver, Halifax, Saskatoon, Toronto, Montreal and, as most of you know, the sod has been broken here in St. John's. I have left out several other locations.

NRC has two mandates. Our first mandate is to be a place where excellence in science and engineering gets carried out by well qualified, well equipped scientists and engineers. Most people will agree that NRC has accomplished that mandate very well. It is nice when you can point to Dr. Hertzberg and say we've got a Nobel Prize. But it is not just Dr. Hertzberg.

What is not known as well is that NRC has a very definite second mandate which in our original terms of reference was given more words than the first, and that is to use that established expertise to the benefit of the Canadian economy through Canadian industry. NRC has not finished its work and cannot claim to have accomplished its objectives if it is only a place where good science gets started. It must see that the economy benefits from that science. As you probably realize, that is a much trickier thing to do.

NRC carries out this second mandate through a series of different activities. Someone has already mentioned that we run the Canadian Institute of Science and Technical Information and the Science Library; that's part of making science and technology available and useful. We also maintain several major unique expensive national facilities. The wind tunnels are perhaps the most famous. The facilities here in St. John's will be equally famous. We are also charged with the obligation of maintaining the time standard, the fire code, and other standards and codes in Canada. These are things that NRC has to do and we must do them.

NRC's laboratory structure also consults freely and frequently with Canadian industries. It answers questions on a day to day basis. Unfortunately, most of Canadian industry doesn't realize how available the NRC scientists and engineers are. They will answer the phone, they're there if you want to knock on the door and walk in. Many people think of the NRC as the "Ivory Tower" and think the walls are unscaleable. That is not the case. We are open to your questions. This is a tremendously powerful way of fulfilling our second mandate even though it's very hard to quantify it.

NRC manages the two industrial assistance programs, the PILP program and the IRAP program. Through those programs, annually, more than 500 companies in Canada get support. The question is support for what. Peter Lewell said earlier today that the industry can't get a grant unless it has a research lab. He made his point and now I'll make mine. It is really not quite so. In fact, in what used to be called MINI-IRAP (the small projects program - under $30,000 IRAP grants), the norm is that the company has no research facilities but it gets the money from NRC in order to employ people who do have. So the company can in fact subcontract to PRO's, to universities, to consulting engineers, or in fact use the contribution to employ its own technical people. This is a very important aspect of our programs. If we limited ourselves to only those companies who have research staff, we would be limiting ourselves to too few companies. Peter's point, I think, is fair to say that IRAP has a very cleancut and convenient limit on what it will fund. It will fund salaries and benefits, nothing more. Any company that is dealing in the funding side of the IRAP program will send the invoices related to the time spent by scientists and never mind sending any bills for materials and overheads, because we just don't pay, so it works out that IRAP covers about 45% of a research program.

I said NRC is a big lab and that's our strength but it is also our problem. Most of our labs are in Ottawa and labs by their very nature aren't very portable. Most of our program administrators live in Ottawa. Most of our scientists and engineers live in Ottawa. So while NRC is consciously moving some of its facilities into other regions of Canada, there will always be a high degree of concentration where the facilities exist and this is a problem. Not all industry is in Ottawa, though the Ottawa Board of Trade may like to think that it is, so this is where our working relationship with the provincial organizations comes in. I was obviously very proud and very pleased to listen to Dr. Pepper, Dr. Lewell, and Dr. Trick talk about how they enjoy the working relationships with NRC, because that is the way it should be. The National Research Council labs and the provincial research organizations are in no way in competition with one another. My boss, Keith Glegg, says that we are in the "wholesale" research business and they are in the "retail" research business. I guess that is probably not unfair. Another way of putting it is that we are in the generic research business and they to a larger degree are in the proprietory research business. They get more involved with research at the company level and, by our very nature, we don't tend to get involved in things which are proprietary to only one company. Our results must be available to any and all companies in Canada.

What does NRC need from the PRO's? We need the regional sensitivity, the local knowledge of the needs of local industries, in order to deliver our program and to deliver our technology more effectively, to implement our technology more effectively. On the other hand, the provincial research organizations need us. They need access to a big lab that does things over a longer time frame. We want to be available. That is why, through the IRAP program, the part that was known as TIS until recently - the Technical Information Service - NRC has approximately 22 of our own employees distributed across Canada and 35 contracted employees, many of whom are employed with the PRO's, to work with us in delivering our services, our technologies, and our programs to the industries in the local regions. Perhaps the best example is that in the Manitoba Research Council, where Gordon Saunders, our man in Manitoba, lives within the labs and has people from NRC reporting to him and together they work to deliver what NRC has to offer and what NRC has to offer. It is a lovely working relationship. I am not trying to say

that is the only example but it is one which comes to mind.

People are a lot cheaper than R & D programs, but we are very happy to spend within the PRO's to build up their resources as well. This is because, in their own special way, each PRO is a national facility.

The Ontario Research Foundation, for instance, is a national facility when it comes to ceramics technology. Each provincial research organization can, and many do, pick an area very relevant to the industries in their region in which they become experts and we are delighted and in fact are dedicated to making that expertise available to companies in other parts of the country. I personally believe and I know that NRC does believe that this partnership will only get stronger as we get more familiar with working with one another, at least in the technological areas, and in the industrial development area. This is one federal person who says that federal cooperativism is not dead.

Holmes: I would like to give our comments briefly on the White Paper and also move on to give you a few ideas of how we operate in Industry, Trade and Commerce at the present time in terms of industrial R & D programs and how they apply in the Province of Newfoundland and perhaps elsewhere. I also want to give you some comments on what it is like to do busines in the R & D field in Newfoundland, at least from our perspective.

As I said, our comments are primarily on the White Paper. First of all, we thought it was very much in line with generally established policies as outlined in the November, 1980, Federal Budget, "Economic Development for the '80's". Specifically, our comments in brief are that you should develop an indigenous capability or ability to develop and apply technology. This technology must be original in an area like Newfoundland and suited to the situations that we face right here. This should not be a mimic of technology elsewhere. This is related to your leap-frog approach that is mentioned in the White Paper - that is essential. An example, not from here but from elsehwere, is an aircraft company, Canadair, which required an indigenous technology capability and used the leap frog approach into some truly innovative developments which they are now seeing the results of. These are their own developments. Japan, of course, did this in an excellent way and are still doing so. They organize things much differently than we do in Canada. They have much more of a team approach - something that has been alluded to here - and if we ever reach that, it will be an interesting turn.

Another item we recommend is that, in looking at R & D, we must first understand what is going on right here. In other words, "what is the competition?" We are in an international competitive market whether it is R & D or straight manufacturing.

Universities and other research institutions must play a much more important communications role between governments and the private sector. This has been a long-standing problem, and we believe that it has come a long way but it must go further. We also feel that the provincial groups should make more use of some federal government institutional support programs. Thirty-six such institutions that now exist across Canada avail themselves of this type of program but there are none who have done so in Newfoundland.

The paper that was given by the Council of Maritime Premiers hits the nail on the head, and perhaps you have discussed these already this morning. We have identified that the major barrier is the weak innovative capability of the industry, and one of the strong recommendations in the council report was to strengthen the company's capabilities to innovate.

Moving on to some of the things that we are doing on the federal scene. This is all the federal departments. The total direct financial assistance support program in R & D totals $275 million per year. This is direct and doesn't include indirect contributions.

One of the interesting things coming up through our department is the Industrial Opportunities Program. The aim is really in targeting the most promising areas in industrial strength that we have in Canada. We approach this from a corporate viewpoint, which is getting closer to market than we would in universities and pure research organizations. Again, this is a message to go on the strengths.

I think it is worthwhile just to review for a moment the processes or factors we look at in the company's technological evolution from start-up to maturity. We have initial research and development, we have product and process design, innovations, prototype development, organizational change in the company, marketing innovation, market testing, and we also always get into various periods of restructuring. One of the most important aspects is what the company has done to promote research and development and how it can be applied to a community. A company's activities have to be put into the perspective of the marketplace, especially in this day and age when we are facing very tight economic conditions, short markets, and in many cases lower foreign prices.

Basically, I will summarize here what our local problems are when we deal with industry on many of these programs. (1) There is a management problem. There is a very great problem in having a business perceive itself as an independent business in this province. To go with that, we have a real lack of risk capital both from the shareholders themselves or from outside investors. (2) There is also, in this area, a market problem, and it involves the small local size of the market and the distance from the market. It is not like Ontario and Quebec. (3) The other problem is the number of firms and their size. The previous speaker alluded to this but we can count on two hands the manufacturing firms over 100 persons in size. You can count on one hand the number of firms in this province that have a potential to do sustained R & D.

There is no shortage of innovation and ideas from the business community but implementation poses difficulties. This is why we work with the provincial Department of Development and we use the team approach where possible. We try to put together a package of assistance for a firm. One of the problems is the FBS syndrome - what I call the Free Bucks Syndrome. Again, this is from some viewpoint of "not wanting to take that big plunge". An entrepreneur is ready to plunge in terms of time but far less so in terms of dollars. We try to take the initiative in approaching companies because you don't have massive numbers of applications coming in on development projects. We have to approach firms to encourage them to look at this or that development.

One other thought is the lack of research and development in a major industry sector. Look at the fishing industry, for example. It is of widespread importance in the province, yet there is almost no research and development done. This has to change. That's why you have to try and promote this capability within the individual companies.

Le Roy: (Scientific advisor on Science Policy from 1978 onwards and recently Special Advisor to the Science Council of Canada). I bring you greetings from Maurice L'Abbe, who is our Director, and also from our new Chairman, Stuart Smith.

The Science Council of Canada is in the position of not being an operating department of government. We cannot fund large programs, etc. The only thing we

can turn out is advice and whether it is listened to or not depends on how good it is. That may be a tougher game of course than passing out money, which is always welcome.

The Science Council has a continuing interest in the development of science policy by the provinces. This is a development which we in the Science Council believe is very significant and very healthy. Science policy is too important to be left only to the national government.

In line with this thinking, a year ago last January the Science Council convened a meeting at Mont Ste. Marie in the Gatineau Hills, to which we invited representatives from the ten provinces to discuss industrial policy and science policy. The purpose of that was to exchange ideas and come to grips with common problems in the area of science policy and industrial policy. Of course, one cannot really separate the two and one should not try to separate the two to any great extent. Following that meeting, the Science Council hosted the provincial research organizations last fall, because in many respects they provide the first step in the development of science policy in any of the provinces.

In 1944, the Science Council of British Columbia was started, and it operated as a research council right from the beginning. But it was only in 1978 that British Columbia formed their science policy council. This often happens.

The development of provincial science policy structures is a topic which came along in many cases after the research organizations were in place, and one has to, I believe, clearly bear in mind the different roles of these two kinds of organizations. Some examples of the down to earth nature of many of the PRO's have been heard here today. I will give you another one.

A newspaper in Quebec was reporting on a session in the Legislature in Quebec where the Opposition was critizing some remarks that had been made during the Session of Parliament where the Quebec version of the PRO was giving its five year plan and this opposition member mentioned that "it looks like there is something seriously wrong with it because only 50% of its money is spent on R & D. How can it ever hope to do anything for Quebec industry if only 50% is spent on R & D?" Presumably, he had assumed that the rest of it is used in administration. That opposition member missed the whole point. PRO's have to do a lot of work that is not R & D.

An important point is that science and technology must never be confused with research and development. And yet, today, I heard them used almost synonymously. The transfer of science and technology may involve no research and development, but it can help a company become viable.

That's the general feeling that I have regarding the discussion that we have had today in the context of where Newfoundland should go. Some talked about a Science Council. I think that a Science Council for Newfoundland would be an excellent idea. In many cases, if you don't have a PRO, then you leave it to departments and, generally speaking, that is not critical at all. But departments tend to departmentalize everything they do. For example, the Canada Employment and Immigration Department, within the last year, did a major study of manpower requirements at the trades and post-secondary non-university level. If you read through that report, you will see no reference to the 1.5% target of gross expenditures on R & D as a percentage of GNP. Yet, they were, presumably, concerning themselves with the future requirements for manpower. The words like "departmental" affected them so much that they found themselves out of contact with their colleagues at MOSST, who of course

deal with the R & D aspect and had announced the 1.5% target. You tend to find that kind of thing if you leave it to the departments; by their very nature, they will departmentalize things. Therefore, a science policy group that can take an overall look at these things and tie them together is terribly important. I hope that the actual form of it will work out to be most effective, because in Newfoundland you've got very special potentialities for development of science and technology and its application, where you have the capability of being leaders in Canada and also, elsewhere, in bringing certain kinds of technology to bear on fisheries and renewable resources. I'm sure you have the capability to do that.

Question for the panel: I wonder if one of the panel could comment on the relationship between NRC and the Federal Fisheries Research Centre here in St. John's. It is very obvious that the research is largely biological. I wonder for instance in a specific example if one wished to research a method of getting fish in without using trawlers. The trawler seems to be becoming very old and very expensive and half the fish companies are blaming them for going bankrupt. Who would do the research if one wanted to bring in fish say by some magnetic field or electric lights? Who would undertake such research? Would it be our own Federal Fisheries Branch here or would NRC get into it?

Le Roy: You have touched on a very important point. I see it not only in fisheries but also in agriculture, forestry, and other areas. Fisheries as an industry is not the same as fisheries as a discipline. We just haven't faced up to this. I think there is a good opportunity for a fisheries research team to bring in engineers as well as biologists.

Coderre: If I understand your question correctly - who decides which laboratory undertakes such a program? There is one good thing which seems to be happening in Ottawa. There is a tremendous increase in dialog between the various science-operating federal departments to get industrial opportunities programs going. For instance, there is a committee of the Science Assistant Deputy Ministers that includes all departments that are involved in carrying out scientific research, which would tend to make sure that there wouldn't be any major projects that fall in the cracks or get duplicated. Things like that are happening. Another example of a kind of multidepartmental program is for instance the PILP program. As of April, 1981, that program was officially consolidated with the technology transfer programs of all the other government departments which do research. Now we have one program administered by NRC with which there are program managers in eleven different departments and all meeting at the same table to debate the programs which will get funded. So there is a lot more dialog which is beginning to work against the old and very real isolationism that Don was referring to.

Le Roy: I think that I might add to what Bill was saying. I think that what you need is much more of a task force approach on these things. A task force may use any particular vehicle. The task force would evaluate the particular departmentalized programs for each department. No one departmental program is likely to fit all circumstances.

Comment from the floor: There is no segment in government which could address the problem of the particular question which was just raised. In Provincial Fisheries in Newfoundland, we do have a program of R & D dealing with the industry rather than biological research. It is more technological. The question of fishing with lights, etc., is one which comes under that particular program. As for Federal Fisheries, I'm sure that Mr. Mercer can comment on that.

Mercer: We are spending $17 million per year in fisheries development. Of course, developing transfer technology is another issue. There are some works which we have undertaken with the province and Memorial University and a small amount of technology development takes place not in our research group but in our industrial development branch and there is a fair amount of liaison between the two groups.

Palmer: I found the last question to be a simple request for knowledge. What lab or what institution now does research into new methods of fisheries? Is there one place, St. John's White Hills, or is it somewhere else?

Le Roy: The way the conversation was going, I couldn't help but think of the system of tackling problems of a multidisciplinary nature that was established at the same time as NRC was established, in 1916-1917. That is the mechanism of the associated committee approach. During part of my career, I was responsible for the associated committee structure at NRC and I had enough experience with it to be really stimulated by its capability. Although some of the committees weren't doing very well, it is one of the best things that NRC ever did. That approach enables you to bring biologists, physicists, chemists, engineers together to tackle problems. Maybe Dr. Coderre could comment on this.

Coderre: That is the standard operating procedure at NRC. Advisory Committees and Associated Committees. As for the question of funding for R & D projects in the fishery, I am not familiar with all 500 contracts we have this year between PILP and IRAP but it was just going through my mind what kinds of things we are funding today that relate to the fisheries. Here are four projects that I know we are doing and it is not an all inclusive list.

1. We are working with an industry on clam.

2. We are working with another company on sablefish farming, i.e. growing sablefish in pens on the West Coast.

3. We are working with another company in P.E.I. on lobsters, growing lobsters in pens.

4. We have at least four other contracts that have to do with things like vaccines for fish. It's not all electronics.

Chairman: I wonder if I could shift this just a fraction from the point and try to get in Ross Pottie. As NRC Regional Director of the Atlantic Region, do you have any views or information that you would like to give us on this question of relationships, this federal perspective on provincial scientific R & D as you see it at the present time, having been in the region for a while with all its imperfections?

Pottie: Bill Coderre commented on most of our relationships between the industrial programs and provincial research organizations. For programs funded by NRC, we will seek any participants who can advance our own priorities in our use of those funds. At the same time, we are looking for partners who those funds will help or who our advice will help as well to achieve their goals. We include industrial partners, university partners and provincial research partners. Here, we have some of these programs with NORDCO, C-CORE, and Memorial University as well as with a number of the smaller companies in the St. John's area, e.g. Ice Engineering. To summarize it, we have priorities for use of our funds and for development of our programs and we will seek partners to assist us in achieving our mandate.

Palmer: Perhaps I could shift back to Brian Holmes, whose organization has a number of programs with the intent of fostering technological approaches to problems in the private sector. If there were a PRO here like the Saskatchewan

Research Council, do you think you would find the delivery of those programs easy or more effective? What sort of effect would it have on your operation if we had a PRO tomorrow?

Holmes: From the experience we have had in other provinces, the provincial research organizations are involved in a lot of our projects as subcontractors. Often the problem is that a businessman has a very good idea of what it is to create his own R & D organization, but he can't manage it, so the work gets coordinated through the local PRO.

Panel # 4: The views of the other provinces on the White Paper

Chairman: Dr. Ross Peters, Memorial University of Newfoundland (Dean of Engineering)
Panelists: Dr. Tom Pepper, Saskatchewan
Dr. Peter Lewell, New Brunswick
Dr. Gordon Trick, Manitoba

Peters: Good Morning, Ladies and Gentlemen. Welcome to the session on the views of the other provinces. I'm sure there is a lot we can learn from these colleagues from the other provinces who've gone down this road before. Yesterday afternoon, members of this panel spoke about their own particular organizations and how they operate. Today, they're going to give their views on the Newfoundland White Paper.

Pepper: First of all, I'm going to try to confine myself to ten comments.

Number one certainly is to congratulate the organizers for the White Paper and also to congratulate them on recognizing that it is the first step, and to suggest a caution. In Saskatchewan, we have had lots of first steps and then no other steps and that is very dangerous. I would like you to recognize this and make sure that it doesn't happen to you.

Actually, what I am going to do is try to tell you some of the mistakes that we've made, and some of the weaknesses that we have experienced in Saskatchewan. I'm not trying to take that "holier than thou attitude" when I comment on your White Paper because I have no right to take that kind of attitude.

Secondly, I would like to congratulate you on recognizing the related scientific activity (RSA) as an activity and urge that you upgrade the importance of that. It isn't so romantic or dramatic as winning the Nobel Prize but I must say that R & D has an aura about it. The related scientific activity does not have that aura but, in my experience, it is the related scientific activity that produces the goods, in many cases, at our level of development in Saskatchewan.

I would like to comment on a number of the concepts and statements in the White Paper.

Page 1) The evolutionary approach, as far as I'm concerned, is bang on.

Page 7) The leap-frog approach, again, I would say is bang on. A bit of caution there, from my point of view, is that, if you consider emulating or using the Japanese model as justification for the leap-frog approach, you must realize that Japan is dealing at the national level with national powers of trade and taxes and things of that nature and you in Newfoundland and we in Saskatchewan don't enjoy that, so it is a bit treacherous to say that you can follow Japan when you're dealing at the provincial level.

Also, congratulations on the "appropriate technology" approach on page 9. Again, I think this is terribly important, for quite often you should downgrade the existing technology to apply in your situation. Stick with it and emphasize the "appropriate technology".

I think probably the most important item of the whole White Paper is embedded in the first sentence. "In March, 1979, the Task Force of Science was created under the authorship of the Premier's Office." I would emphasize that if you end up with an advisory committee, an advisory anything, find out where the power source is in the province and align yourself to that power source. The biggest mistake that we made in Saskatchewan was to set up the Science Council under a line department, the Department of Continuing Education, where it really didn't receive the respect or the authority that an advisory organization ought to have if it's going to be useful.

Your White Paper has been authorized by the Premier's Office. That is your power source, so tap into it. I really think that is the most important thing I have to say, especially if you end up with an Advisory Committee.

I see a section in your "Introduction" on the weaknesses in technology transfer. I would suggest more emphasis should be put on the managerial aspects of technical activity, the managerial sciences. In Saskatchewan, we have a whole bunch of home grown firms. One man conceives and operates the firm, sometimes successfully and sometimes not. One of the biggest weaknesses we experience in these little firms is the lack of managerial competence and, if you have a similar sort of situation in Newfoundland, then don't overlook the need for managerial technology.

Also in Saskatchewan, we are terribly conservation conscious. I don't see much reference to conservation in your White Paper. That's an area that needs a little more looking into.

With regard to technology transfer, I would also like to endorse the NRC position and what Bill Coderre has said. In my own mind, you cannot overemphasize the transfer activity. It doesn't have the high profile that R & D has and, therefore, in that sense it may not be all that attractive to the universities, but I can't overemphasize it. There's real value in effective technology transfer.

I still have a lot to go through yet but, since time is running out, I will go to your section entitled "Priorities in the Marine Sciences". I agree with that but don't blinker yourself. The Saskatchewan Research Council is trying to do certain activities and is setting up priorities but it is so hard to predict the future. Go back five years and try and figure out if we thought we would be where we are today. We must look sideways and keep an eye on other things that may creep up on us.

More emphasis could be put on activities associated with technology assessment and technology forecasting. Technology assessment could spill over into the social sciences and I have a comment on relationships to the social sciences for the question period.

I will wind up by saying that I bring the very best wishes of Allan Mode and Gilles Cloutier on behalf of the PRO's. I would like to say that, no matter how you end up, you can call on us for a list of mistakes and whatever advice you need. We will help you in any way we can. PRO sends its very best wishes for the success of your Science Council or whatever form you decide to take.

Lewell: My comments are made as one who has no particular indepth knowledge of Newfoundland but is trying to manage a PRO in another have-not province. We don't have a lot of manufacturers either. My job really is trying to keep the survival of the PRO, while at the same time trying to play a role in a rather vaguely defined industrial development context. We are not simply just another department of government. We argue that all the time with our provincial government. This is the one overwhelming prejudice that I have that

is based on my experience. Without strong provincial government financial and moral support and cooperation among the various provincial government sectors, a new PRO will be a tough bird to get airborne. That's my overwhelming prejudice.

I have some specific comments on your White Paper.

A Science Council for Newfoundland to act in an advisory capacity to Government would be worthwhile and a good idea, for all the reasons cited in the White Paper and perhaps a few more. Maybe it should also be expanded to embrace the social sciences.

The Science Council will have limited effectiveness unless (a) provincial expenditures on R & D are increased as you recommend in the White Paper and (b) the Science Council has a voice in how these expenditures are allocated. The credibility of such an organization depends very much on how the funds are used. What the world and Canada probably don't need is another advisory body on science that has no spending clout. I'm not suggesting that you spend the funds directly as the Science Council but at least you should have some input into how the money should be spent.

Nature abhors a vacuum. Bill Coderre said that yesterday. It's a really good point. In the absence of a PRO over the years in Newfoundland, other R & D and RSA organizations have developed. I worry that, if a PRO is established now with brick and mortar and facilities, it will primarily compete for scarce R & D resources both in Newfoundland and in Ottawa against these other provincial actors.

I take the point from the others that they would like to see a PRO in Newfoundland undertake R & D projects and this is the case certainly in Ontario and Quebec. Our experience with R & D in New Brunswick has not been so buoyant or so encouraging for us. We find that there is a terrible tendency for small manufacturers who haven't got much technical capability for R & D to bring in a consultant from Ontario or some place and spend $35,000 or whatever. The guy comes in, spends his time, leaves, and we never hear about it and the company has not benefitted.

Now, the case against going for a PRO is enforced, in my view, by the priorities that you have given in your White Paper. The very area where you have the most R & D and RSA capacity now is the area you have defined as the priorities for the future. If, on the other hand, you had an abundance of diversified small manufacturers here and you had a priority and need to address the R & D technical requirements for manufacturing in groups which the existing companies weren't doing, perhaps a PRO might be more appropriate. Then it should be expanded much more efficiently.

The White Paper recommends an increase in provincial expenditures on R & D. I strongly support this and I strongly recommend that this be the # 1 priority for your Science Council. At least initially, I recommend that these expenditures be program oriented rather than allocated for capital investments in new buildings and the payment of the overhead on those new buildings.

The program expenditues could be in the areas that I spoke of yesterday. These are areas where I would like to see our provincial government in New Brunswick take more of a lead. The three main areas (which I encourage you to emphasize) are:

1) Piggybacking on existing Federal R & D programs. The Federal Government has put a lot into R & D over the last eighteen months to two years and is going to put a lot more. The problem that we have in Eastern Canada is using this money effectively, given the constraints

that we have with our manufacturing base. How do we spend R & D money in industry when industry does not have any R & D capacity?

2) The selection of a few large scale core-funded initiatives possibly utilizing some of your existing facilities.

3) Technology transfer. Setting up a provincial mechanism whereby you can exploit new technology whether it is developed here under one of your core-funded initiatives or by an agency like NORDCO, or developed elsewhere and brought in, for example, using the PILP program or NRC technology or whatever.

Another comment is that to pull it off you will need more R & D funding, but you are also going to need strong leadership on the part of the Science Council to direct the expenses. So we come down to the two things that I see in the White Paper as being the most important; namely, (a) the increase in provincial government expenditures in R & D and (b) the putting together of a Science Council that will act as the decision-making agency to indicate how these expenditures should be made.

Finally, by way of criticism, I find your priority setting exercise unnecessarily severe. The White Paper focuses on renewable resource development and on the marine sciences in particular. I would not rule out such areas as mineral and peat land development in the nonrenewable field. In the forest protection field (in the renewable field), I consider forest protection high on the list and something we do very actively in New Brunswick. I would also recommend such high technology fields as materials research and electronics, particularly in your own Newfoundland setting. For example, I have seen from our organization specialized testing on the oil rigs in Marystown. It struck me as unusual that this kind of expertise is not present in Newfoundland and you have to bring in skilled people in this field from New Brunswick.

Finally, I certainly support Dr. Pepper's view that conservation is another area that should be listed as a priority in your White Paper.

Trick: As Dr. Pepper said, the provincial councils do get together periodically. We keep struggling with how similar we are and yet how different we are.

Certainly, first, I would like to congratulate those who were instrumental in developing the White Paper and then those who organized this meeting. Things like this cannot just happen and I want to first emphasize that, in undertaking any task from this White Paper, a commitment must be made from the highest level of government, the university people and the business people. Otherwise, you will be thrashing around in the bushes frustrated. I don't feel yet, at this time, in Manitoba that I am working in that kind of an environment. Let me tell you, it is a long hard uphill battle.

People are going around saying "science policy is an important thing". Having said that science is important, I have to backtrack a little and say that to me it is important when it has a goal. The goal may simply be the creation of good science itself. That's fine. Maybe the aspiration of Newfoundland is to win three Nobel prizes. That's fine. What is important though is to understand what the goal is, and in examining the White Paper and examining my experience, there seems to be a big gap between the generation of scientific information and the final goal, which often is defined as bringing about industrial and economic development.

The gap between research and economic development is, I will suggest to you, maybe three times as wide as the

room we are meeting in today. It is a tremendous gap and, if moving through the White Paper process is to generate multiplication through manufacturing in this province, then I think that aspect has to be looked at long and hard.

I want to clear up any misunderstanding. There is nothing wrong with creating a brain center here. A brain center that is based on resources, on marine technology - that's great - but understand that this is not necessarily part of a process that leads to a manufacturing base.

The concept that manufacturers or innovators are standing at the back door of a research lab looking for ideas is wrong. The concept that technological development came about by ideas coming out of great research labs is mostly wrong. It came about because people were there who had a commitment to do something and most important is when the person from the lab picks up that idea, puts it under his/her arm and goes out the back door and starts a company. That requires a certain type of skill, a certain kind of attitude, an attitude that I admire and yet sometimes find difficult to understand.

Another point, which has already been alluded to, is that you already have here a number of organizations that relate to the priorities of the White Paper. I think it is essential that those organizations give a real commitment to this task, a commitment to your province, and a real willingness to cooperate. Certainly, I don't know your province, so I can't be critical but I simply say that I know and have seen organizations in other provinces where some kind of commitment has been made but for internal gain rather than for the gain of the province.

Do you need a Science Council? If you mean one which does like mine, which supports secondary manufacturing, then you have the problems pointed out to you. However, if you want to establish a secondary manufacturing base in this province, or strengthen what you have, then some steps will have to be taken. If it is on a technology base, this kind of process is the one. Just recognize that, in addition to this White Paper, there must be a tremendous activity in getting these entrepreneurs and giving them the skills that are needed, giving them the commitment that is needed to bring about multiplication from this task.

For several years, we operated with no labs and very small staff. A lot can be done by people like that, people that have the experience in industry. The labs are not essential but eventually their absence becomes frustrating. People would come to us with a piece of plastic and say, well, what kind of plastic is this? Eventually, we found it necessary to get some labs.

All I can emphasize again is to be sure of the goals of the task you are setting and don't think that you are approaching one set of goals only.

Question from the floor: I would like to ask the panel if there are many opportunities that we can have in conenction with the federal government. You indicated a working relationship with the federal government. I'm curious as to how you would react to the technology programs that are now coming out on a regional basis, for example, the four Atlantic Provinces are grouped together. In the face of that, how can we develop?

Trick: Discussions are taking place among the four western provinces on some understanding of how to share scientific activity. There has been some cooperation in that area coming out of the Science Council. I don't want to be unfair to those involved, but my perspective concerning science as it is related to industrial development is that I don't think that, by any mechanism, you will get the provinces to agree very much on industrial

development. I will leave the Maritime industrial development to the Atlantic Provinces but I won't leave microelectronics to any province competitive with mine.

Pepper: I have to agree with what Gordon has said. I haven't yet gotten into bed with anybody that I hadn't wanted to get into bed with. I think you are referring to the most recent federal shuffle and emphasis on regional help and regional development. We haven't felt that yet, but in fact we are endeavouring to organize a meeting of PRO with the appropriate federal government departments to try to work out some sort of an understanding. It is not clear how that is going to go.

I would like to pick up on a couple of things that Gordon said. One, in Saskatchewan we are endeavoring to put into effect what in our language plan we call a "cooperative principle", relative to technology, on the grounds that the Saskatchewan resource, and here I mean the manpower resource, is limited and may at times be more limiting even than the financial resource. So to cope with that, we are trying to emphasize what we call the "cooperative principle", which means working with the universities and industry and so forth. The "cooperative principle" is still, however, a self-serving, self-preservation principle. All provinces are keen on surviving and so we have got to find some selfish motive in whatever we do. In my own cynical view, you've got to have a payoff before you can implement the cooperative principle.

Lewell: Industrial development is too political an issue to be shared among the provinces, I am sure. For example, if the federal government has got $1 million to spend in microelectronics, we would much rather see them spend $250,000 each in four provinces than $1,000,000 in one province, because we are afraid it would not be in New Brunswick. We would find it very difficult to go to a manufacturer and tell him that a computer design team will put off a great demonstration project and all they have to do is go down to Halifax to see it. There is nothing in it for us. I guess that's the problem.

Palmer: It is a shame that it is politically difficult to do that. Your own examples and recommendations point that out. For example, should Newfoundland perhaps look into getting into the activity of forest preservation? You are at it and you've been doing it for years; you have all your things established. Why shouldn't we just swap? For example, Saint John Shipyard can come to us for whatever, like ship testing in ice, and we split up the centres of excellence.

One of the things which one questioner was referring to is that there is a move or message coming from the federal government that you provinces each are going to have $250,000 in your region and in that region you have to be prepared to transfer this or that or some other piece of activity and you must get together among yourselves and decide who is going to have the biggest piece of which pie. It makes sense but you don't like it coming from outside, and it is politically unacceptable. So we are left with a continuing dilemma.

Lewell: Oh no, I think that the economics of scale favor the $250,000 activity gathered in one group. For $250,000 you can put in a computer terminal, you can put in a couple of people to be programmer analysts, to be able to educate people, to get into new concepts here. It is very often preferable to have some guy working in the field on a limited scale, but he's here, as opposed to a half dozen of those guys working together somewhere else. For example, we are doing work on the Hemlock looper in Newfoundland. Maybe because we are doing that, you don't have an entomologist here in Newfoundland who is able to make a

living in the bug business. Maybe there are other pests to work on in Newfoundland that we will never get around to learning about. I think the economics of scale are not beneficial to a subdividing process where you can undertake things on a provincial basis. Why should we be the only people in Canada who are forced to do this anyway?

Question from the floor: I think that a common comment from each of the panelists has been made in reference to the need for some form of power in the hands of a Science Council and that the idea of increased expenditures is a good one. What has been the experience with each of your councils with the success in encouraging increased expenditures and to what extent has your organization attained some measure of control over how those funds have been spent?

Pepper: At the Saskatchewan Research Council, we have done quite well as far as the provincial grant is concerned. Because we are a dual agency and can protect and defend ourselves with our actions, it is less crucial that we answer to the seat of power. We would have done better, however, if we had had the Premier's ear, which I believe is the situation in Alberta.

As far as the Saskatchewan Science Council is concerned, my point is pretty well illustrated. The first meeting of the Science Council of Saskatchewan produced a great promising speech from the Minister. When a budget squeeze came, half a dozen positions assigned to the Secretariat were found to be dispensable and the Science Council is now in a kind of zombie state, awaiting some statement on research and some injection of hope from a new study. I think we have definitely suffered from not reporting to a seat of power.

If you are involved in a dual agency, i.e. receiving funds from both a grant and contracts, you are quite considerably protected by your own efforts. If you are an advisory agency, you are terribly vulnerable. We in Saskatchewan have demonstrated those two aspects.

Question from the floor: I would like to ask the other two panelists to give their experience in that regard, or to amplify what they said in the beginning. This is a very important point. I think that we have two clear choices in Newfoundland as to which way we should go.

Lewell: Our experience has been the opposite to Saskatchewan. Our provincial government support has stayed in the same constant dollars, or in fixed dollars, since 1967 and that means we do not now undertake any of our now initiatives. We have the flexibility to carry on any internal research projects which might lead to growth in our overall activities as we can bring them to a certain point and then get some support for them further down the road. The reason for that is that we probably get the most of both worlds. We appear as a budget item under a line department but our Act states that we are accountable directly to the Premier. That means that the Premier will pat you on the head and say, yes, we need you but then someone else determines what money you get. Because we do not report to that particular minister in the line department, he does not really take very good care of us in the budgeting process, unless we go along and kick him in the shins and then he doesn't like us very much. I think you certainly have to be one or the other. Don't report to one but get strapped by having your funds come from somebody else.

Trick: In the last 10 years, if you look at the provincial activities related to the things I'm involved in, the expenditure has gone up by approximately a factor of 10. I don't just support spending more money. I first want to see what is to be expected from it. If it's to be an image of support by the Newfoundland government for science and technology, let's understand that. If

it's to create jobs for university graduates, let's understand that, if that's the goal. If it is to create a secondary manufacturing base in Newfoundland, then make sure it is measured in that way.

Question from the floor: I am wondering what seem to be the proper things to do in regards to setting up laboratory facilities. Do the provincial research organizations control their laboratories or are they shared facilities with some provincial line department?

Pepper: In Saskatchewan, it was the need for facilities and staff dedicated to longer term jobs which called for the transition of the Saskatchewan Research Council from being only a granting agency, i.e. making grants to universities in support of research. We did only that for the first ten years. It was the need to undertake long term, less dramatic or less university-appealing jobs which caused us to get an operating facility and permanent staff. At the moment, we do have control over the facilities which we use. We don't use very much the other existing facilities in the province which come under the government departments and the universities. In fact, I believe that's one argument for a PRO or PRO-like organization. A number of government departments and agencies may need an electronic facility, for example, but their terms of reference and the level of their needs don't justify their building an in-house facility. One of the real values, I think, therefore, of a PRO-like organization is that it does provide a facility and equipment that can be used and shared by a number of departments and a number of agencies in the province. This is one of the things you might want to consider in your argument for having a PRO or PRO-like organization, i.e. that you would provide facilities for common users. In Saskatchewan, that common user situation is an argument for a PRO or PRO-like organization. We have actually developed the province's prime chemical analytical facility and it is used generally in the province. We have developed a fine electronics service facility. We are a province which hasn't got a lot of electronics capability so it became natural for us to develop it. We do share and work with the university in certain areas. There are other situations where we rely on other agencies, but the emphasis has been for services to concentrate at the provincial research council.

Lewell: I think you have to fight the old DREE idea here when it comes to capital funding. Here is some money to build a PRO but it has to be spent by the end of March, 1982, and after that we don't want to hear from you. That leaves you with a PRO that is filled with 1982 technology and you have to fly with that for maybe another ten years. In the kind of business we are in, you are only as good as the sophistication of your instruments. I would much rather see some kind of a deal where you get your building say in the first 12 months and then you get your equipment over the period of a decade or at least you get some kind of a tradition for an annual amount of equipment being purchased. Otherwise, you are obsolete from day one and you have had your shot at the ring and they don't want to hear from you for another decade.

Question from the floor: What about sharing in your particular case? Do you share very much, for example, with the University of New Brunswick labs?

Lewell: As a matter of fact, we do. That is the mechanism we developed for our equipment. We had to recently purchase a $200,000 item and we had to have it in order to stay in the business of forest protection. We had $50,000 to put in and we were able to get the rest from UNB and elsewhere.

Trick: We are very small in size. Funding came from federal/provincial dollars. We have people from the private sector renting space in our building,

especially the chemistry lab. They work a few days per week. It depends on how much they want to accomplish.

Question from the floor: The White Paper talks about a Science Council as an advisory body. Most of the panel are representatives of provincial research organizations. Do the members of the panel have support for two such groups or are such groups operating in your province? One in an advisory capacity and the other in an operating role?

Pepper: In Saskatchewan, they are. The Saskatchewan Research Council whom I am paid to be with and the Science Council, which I am not paid to be with. The Saskatchewan Science Council as an advisory body has been a flop because we haven't answered to the power source. We argue up and down whether there should be just one agency or two agencies. It depends considerably, I think, on whether the Science Council should be an actual advisor to the power source. If so, the answer probably is no, because the Research Council is an arm's length organization and it must remain that in order to have credibility with the private sector. Whether the Saskatchewan Science Council is to be an internal advisory agency to the government isn't quite so clear. I am still a little confused myself.

Lewell: We do not have a Science Council in New Brunswick. Our Research Council is simply a Board of Directors for a provincial research organization, and it is governed accordingly. We do not have a group that is advising the government on science and research activity.

Trick: The Manitoba Research Council is, at the moment, fulfilling both functions. We do some things; we advise government on others. We encourage others to do things directly. There is good and bad. One aspect of it that has been observed is that, with an independent body, there will be a tendency for the government to take notice. It is essential for one thing that a Science Council must have some kind of a Secretariat. I don't think that it's a part-time job. Unless caution is taken, that Secretariat will tend to grow and grow and you will have two parellel groups and become confused as to what a PRO is. Keep them both together and not in opposition to one another.

Question from the floor: How do the PRO's relate to education formally? How do you handle criticisms about competition for public funds versus private funds?

Trick: In education, if you mean in the research education area, we don't have a formal working relationship. In the education area itself, we have to do things that we would prefer to see being done by our colleagues. In terms of private and public competition for research funds, there is not a strong private base in Manitoba doing the things we do. We have an excellent relationship with consulting engineers and we find them to be strongly supportive. We have had a few problems with competition, such as industrial designers. Our view is, in general, that in some cases we will compete and take work away from others, but our role is to help the whole province. In the long run, the private sector will benefit.

Question from the floor: Is there really a need here for a PRO? I am thinking of the eventual doers of research. As you are aware, we have some interesting organizations in Newfoundland. We have C-CORE, which is within the university, doing contract research and core-funded research but the interesting thing is that is has spun off at least a couple of the research ideas into the private sector to stimulate our industrial area. We have NORDCO, which is a Crown Corporation, which is really quite effective. Some people criticize NORDCO but I think it is basically good. We have Newfoundland and Labrador Computer Services, which is a Crown Corporation combining to meet the requirements of

the university, the government and the Crown Corporations. Might we not continue to explore or develop structural things like that so that we don't really need a provincial PRO? Might it not be possible to contract or subcontract R & D through the univeristy, through the private sector or Crown Corporations? Is there really a burning need for a PRO that does research or could we not have a different structure perhaps based along the lines that we have been developing?

Pepper: Three arguments perhaps for a PRO-like organization.

(1) Technology transfer. You must be sure that your existing agencies are prepared to do the donkey work for technology transfer. Otherwise, you need a PRO-like agency.

(2) Common user facility. There may be facilities needed in the province which are not justifiable by any one of the agencies that you speak off. We serve that purpose in Saskatchewan.

(3) An off-to-the-side view of a discipline. In Saskatchewan, we are heavy into agriculture. The Saskatchewan Research Council had a nonagricultural look at agricultural problems, and we have come up with some different approaches. In other words, agriculture is too important to be left solely to the agriculturists. That's another possible argument for having an off-to-the-side view.

These are three possible values of a PRO or PRO-like structure but it wouldn't, in my view, be a normal PRO in Newfoundland. Because of all the facilities you have, it should be a gluelike agency filling in the gaps that you don't have.

Lewell: I'll go out on a limb and say that, at least over the short term, you should have a Science Council involved in funding of existing actors in the field. Only after you see how that works out, if you see serious gaps developing, should you consider something else.

Trick: I guess I have to comment on that. For years, we struggled with trying to organize what we already had in Manitoba. The vacuum that was present didn't get any smaller. It had to be filled, so we filled it, but I'll say that there are still people in Manitoba who feel that my organization is really not doing much and the money could be better spent in the field of new research.

Panel # 5: Wrap-up session

Chairman: I. Palmer, Assistant Deputy Minister, Department of Development
Panelists: R. Dempster,
R. Peters,
W. Russell,
P. Heald, chairmen of the earlier panels

Palmer: Ladies and Gentlemen, this is the final session, the wrap-up panel, where we aggregate a total of 433 years of PRO directorial experience, all in one-half hour. You know the members of the panel, Dr. Bob Dempster and Dr. Peter Heald, both from Memorial Univeristy, Dr. Wilson Russell, now with the Newfoundland Petroleum Directorate, but for several years with Memorial University, and Dr. Ross Peters, also Memorial University. This is one of these sorts of conjunctions of the stars which happen quite by chance where we have a totally academic and, therefore by implication, unrealistic panel. I would like to suggest that, once the panelists have presented their dispositions of the findings of the last day and a half, we then reopen the discussion until our time is used up to take care of the overspill of questions from the last session and the questions and discussion points that are generated by the final panel now. Following that, I will add to the already profound and lengthy thank-yous and give a final summary at 11:30. To begin, Bob Dempster.

Dempster: In the interest of brevity, and I hope, clarity, I intend to make by presentation in point form. I have nine points and these I think are a distillation of what occurred yesterday meshed in with some of my own personal beliefs and ideas and bits and pieces that have come to me through conversation after the discussion.

(1) I think there appears to be a consensus in favor of the establishment of a Newfoundland Science Council. I personally would like to see it called the Newfoundalnd Science and Engineering Council, which would act in an advisory role to the provincial government. I will talk a little bit about that later.

(2) Its aim would be, and this is a direct quote from the White Paper, "economic and social improvements through the technological development of the province".

(3) Its terms of reference would broadly include the physical sciences and engineering, those aspects of the social sciences dealing with social and economic consequences of development, those aspects of the health sciences dealing with safety and occupational health in the work place and, for example, diving medicine, stress, alcoholism, etc., and also health sciences linked to the aspects of social change that occur with and during the social and economic consequences of development.

(4) The council should foster an awareness and collaboration among all groups covered by the terms of reference that I have just mentioned and must define more clearly the priorities of the province in areas such as marine sciences, fisheries, forestry, mining and offshore oil and gas. I tend to agree with many of the speakers that they were too constrained in identifying simply one area of priority. However, whatever they do in looking at these, it should be fairly sharply focused without being blinkered. In identifying these areas of priority, the council should give thought to the possibility of attracting major program funding for one or two priority areas, especially if these areas are also of national interest. For example, one can think of marine transportation and operations in ice infested waters. This coordinated approach to one or two priority areas would prevent individual and often competitive approaches to the federal government from individual provincial organizations. This point raises an interesting issue that, if they are successful in attracting major program funding, presumably they would need to dispense it, so they would then take upon themselves, or would need to have attached to them, a role other than purely advisory. In that, they may be supported by a management support unit that would dispense the funds on the advice of the council and perhaps monitor the research that is done and feed back to the council evaluations of effectiveness of the funding. One way or another, I think, the council will have to get into some aspects of managing funds.

(5) The development of the strong science and engineering capabilities of the province should start in the school system. It should start by instilling an awareness of the opportunities in these fields and in industry in general. At the college and university level, we should give thought to innovative ways of increasing our technical manpower. However, we should bear in mind that technological skills can't be implanted in the absence of technological activity, and that is so, partly, because those skills have to be learned on the job. The implication of that point is that, if we are to stimulate R & D funding

in organizations like NORDCO, there should perhaps be a built-in component for training allowances to encourage training on the job. We have, I give you an example, Newfoundland and Labrador Computer Services. It is a Crown Corporation which serves the three main users in the province and for years it has, without a great deal of recognition, been training people on the job in the EDP field. I think that should be encouraged. While on the subject of training, we shouldn't overlook the real needs for the development of entrepreneurs, technological entreprenuers, in the science and engineering field, and there is certainly also a need for, what I'll call for the lack of a better term, applied sociologists and anthropologists. These are people who can function in a technical team to give advice on possible effects of development; they are people-oriented people. We really do need an applied kind of sociologists and anthropologists.

(6) Systemics can be important. It has been pointed out that R & D in the application of science and technology perhaps comes under the term of related science activities. These two terms, R & D and science and technology, are not one and the same thing. Gordon Trick gave a very good example of how the application of science and technology can take place without a great deal of R & D effort. Also, I think, it should be understood that R & D alone won't stimulate economic development because it is only the first step in the complex process of technological innovation. The other steps include, and I will just summarize these, and by no means be all inclusive, engineering analysis, production planning, manufacturing and marketing. It goes without saying that all of the technological innovation process is based upon a good strong science and engineering capability of people. I think a science policy without action on these other steps of the innovation process would be largely ineffective. That point was alluded to again this morning by Gordon Trick when he said "there's a big gap between R & D and economic development".

(7) We need to coordinate the efforts of groups involved in the general area of economic developmennt of the province. We should strengthen the links between government, industry and the university, and give some thought to how we might share our resources, both human and physical, in order to reach the objectives of the province. There should be a greater encouragement of exchange of people between these different groups. There is some exchange going on between the university and the other two but I don't think it is going on to the extent that it should.

(8) As we give thought to building organizations with capability in the technological fields, we should explore all important funding concepts and two are mentioned; core-funding as a percentage of total funding, which is absolutely essential just to keep the body and the organization breathing while it goes from contract to contract. We should also look at the piggybacking of provincial financial support onto existing federal programs in order to get a leverage effect, to get more for our dollar spent.

(9) This is the final point. In moving towards a science and engineering policy for Newfoundland, let's keep our options open for the future. Let's maintain flexibility in our thinking. Because of the relative underdevelopment of our province at the present time and the very small group of people in this area of R & D and science and technology, we do

have a tremendous opportunity to put in place a unique structure so, while it is very interesting to hear of how other provinces have met their needs, let's learn from them but not necessarily do it that way. Let's have objectives of our own. Let's not be afraid to do our own thing.

Russell: I would like to do my review a little differently from Bob's approach. I would like to run through the main points that I saw in the presentations and I would like to give you a personal opinion; I guess it could be called a proposal for a setup in Newfoundland.

The main point that I saw in Dr. Trick's presentation was that, in Manitoba, the Manitoba Research Council fulfils three main functions, namely, (1) contract research, (2) industrial development and (3) advisory to government. The emphasis is on value added to secondary industries. The highest priority is increasing productivity. I felt there were very good points made with respect to Newfoundland and Manitoba. Although they seem to have a much greater manufacturing base, there is still, as we have here in Newfoundland, a severe deficiency in industrial research. Another point that I thought was very well made was that managers in Manitoba as well as everywhere else in Canada in industry had trouble with effectively assimilating new technology. With respect to the make-up of the Manitoba Research Council with a staff of 40 and two laboratories, I thought it was interesting that the labs were located in industrial parks. We didn't get into that in the discussions but I would like to make a point of it. Funding 25% private sector, 75% provincial government. The composition of the Board of Directors was very interesting. Of the 10 directors, only one was from government, 2 from the universities and 7 from the private sector.

The next speaker was John Fitzgerald. John made two main points. One was that, in this province right now, there is no coordination in the provincial government to allocate its research budget. He also mentioned that $6.5 million was spent last year on demonstration projects and R & D programs.

Paul Dufour, Science Council of Canada, discussed the broad scope in the country and mentioned that there was little tradition in Canada in promoting university - industry - government interaction. He used examples of British Columbia, Alberta and Quebec. In British Columbia, they are doing things that are very positive. The main point was that the Science Council of British Columbia administers a provincial R & D fund. In Alberta, the Research Council is closely linked with the provincial government and that council is a science advisor to government. In Quebec, they've established a separate ministry for science and technology plus they have a Science Council.

Peter Lewell represented the New Brunswick Research and Productivity Council. I thought one of the big points from his speech was the actual title of the council, Research and Productivity. It has been in operation for 20 years and that experience for us, considering we haven't had anything, is relevant. Their funding arrangements are 15% provincial government and 85% contractual research. I think a very important point was made that R & D cannot be profit oriented. The advice that Peter gave Newfoundland is that we should piggyback on existing federal programs like IRAP and PILP. The problem, of course, is that in Newfoundland, like in New Brunswick, there is very little private sector capability to carry out research so our ability to take advantage of these programs is very limited and mechanisms must be developed. Secondly, Peter suggested the province should fund large scale core programs experimental to a

provincial research organization. The third bit of advice was that there should be technological transfer to the private sector.

Dr. Tom Pepper from the Saskatchewan Research Council referred to a TIE (Technology Implemented Effectively) and that was the key to the success of that council. They put their major emphasis on resource industries. Their funding is 30% provincial government and 70% contractual research. In addition to the Saskatchewan Research Council, there is an independent Science Council, and there were some comments made about its ineffectiveness.

What I would like to do now is put forward a proposal, for the lack of a better name, and in some ways it overlaps some of the suggestions that Bob Dempster made. I would like to propose that in Newfoundland we establish, call it a council or an administration, a Research and Development Administration. This administration will administer a fund, and in a moment I will get to where I think this fund should come from. The main functions of the administration would be to advise government on all policy matters, to provide overall coordination in the general direction of the R & D programs, to administer this fund, and to monitor programs for their effectiveness. I think under the administration should come the PRO. The PRO would handle the areas of physical science, engineering, those aspects of medicine that relate to safety in the work place and so on. The PRO should fund experimental programs itself as well as carry out its own research and establish transfer mechanisms for results of R & D to get effectively assimilated into industry. In addition to the PRO, I think that under this administration umbrella would be socioeconomic issues and the management/development issue. I am not going to discuss those because there is not enough time to do so. I think they are very important especially in getting people to understand and utilize science and technology to improve their quality of life.

Having said all that, I would like to come back to funding. The funding should come from the biggest single resource that we have in Newfoundland and that's the petroleum industry. I think the petroleum industry should provide not necessarily all of the funding but a large portion of it and the R & D that gets carried out should not be owned by the petroleum industry. It should be considered a fund that goes into research into marine, transportation, forestry, fisheries, agriculture, mining, any science and technology areas in the province. The fund could be managed by regulation and the industry could be required to contribute to this fund on an annual basis, and the reason they contribute to the fund is that, if they don't, they don't get their permits and leases to drill offshore. In terms of the amount of the fund, I think we should be looking at a considerable amount. I don't think that we should be looking at $200,000. I think we should be looking at a considerable amount of money for Newfoundland but not what Ontario and Quebec would call considerable. Here, I think $10 million per year should be the figure we are striving for. As far as putting out a framework, I think that is all very well but actually doing it is another thing. We don't have, I don't believe, in Newfoundland right now the local talent that you could put together to do all the things that have to be done. We have to develop our existing facilities to do with education and training and possibly through training in industrial research. I would propose that the fund also be used for funds for scholarships, for research exchange programs and academic research.

The last point that I would like to make. There are actually two points. First, we mentioned that in Manitoba they have laboratories and I really believe that, for a provincial

organization to be effective, it has to have buildings and space. However, I don't think that we should just put up a building so that people will just forget about us. We then have a place in the sun and nobody can kick you out if they don't like what you are doing. That has to come realistically with time so, if we had the fund established this year, I am not sure that the very first priority of the PRO would be to get up a massive structure. I believe we should first see what we have in this province and utilize to the best advantage the existing facilities and institutions. And then we see where the gaps are and what the PRO should be doing in filling those gaps and not duplicating them in any way.

The second point I would like to make is that I don't believe in contractual research for a PRO. To a point yes, but it should not be the main source of funding. I believe that this province has a stake in what's going on here and I believe the province should fund most of the research that is done. What will happen, I believe, is that, if you take away a lot of the incentives of private industry to get involved, you end up competing with private research organizations or other organizations that can just as well do the work.

The last point I would like to make is that the province, I believe, must have the majority of control over R & D programs. The concept of piggybacking on existing federal programs is all very fine but let that not be the main focus. The best people to decide what is best for Newfoundland are the people living in Newfoundland and working here and I don't believe that we can get that kind of direction from Ottawa.

Heald: As far as the proposed Science Council is concerned, I find that this project has very strong support amongst the panelists for the general idea and content of the White Paper, and also for the concept that there is a role for a Science Council which is operative and designed to fit Newfoundland's needs. In Newfoundland, we don't have a PRO structure as such. I personally believe, and I detected this in most of the comments from the panelists here, that a move like this would have to be very carefully planned. It is not something to rush into. The reasons were put down quite clearly by Peter Lewell, who is our nearest neighbour with experience of this. In the first instance, if we do set up a PRO, then we are competitive with existing units and, in a system such as we have in Newfoundland, which is an extremely poor province with little money, the concept of additional competition might be seen as a little premature.

The point was made, which deserves to be given considerable thought, that the more organizations one sets up the more separation there is between the individual organizations. In this connection, the White Paper appears to me to be a very serious initial attempt to coordinate and bring together. Again, a most critical point which was made by the panel was that, before any organization is set up, we must state a very clear definition of our objective. We must know where we are going and where we intend to go before we really do anything else more definitive.

Dr. Silvermann gave some information that surprised me a little, that in the Atlantic Region the universities are conducting approximately three times the amount of R & D being conducted by industry.

It appears to me that, if there is to be a science policy in Newfoundland, we will have to recognize that this is going to involve communities like the university very heavily and also the various extension capabilities that exist, for example, in the College of Trades and Technology, the College of Fisheries, and the Trades Schools. The College of Fisheries, I think, has not been given the recognition which those of us who know it reasonably well feel

it would deserve in consideration for development of a science policy. It is one of our most effective and active centres which exists now. This development will involve the balancing of the objectives of any policies which a Science Council is likely to institute with the academic policies of these establishments. In the university, we have to recognize that our role embraces the concern for the humanities and we can't, and I don't believe, we would, support a general policy which does not at some point have a regard for the social and economic impacts on the life styles and the needs of the people. This is a very difficult question in my view because we must consider whether in fact we should be developing the science policy, or whether, indeed, a science policy could be developed anywhere to meet both the social needs of a community and the economic objectives which are desirable in industry. These two things are very often in conflict, as most of us know, and consideration must be given as to whether it is rational to attempt to link them at all. This question perhaps involves more political than scientific judgment but it cannot be avoided.

In this conection, we have several times touched upon the question of science education in the schools. It is a real need for us in Newfoundland and I think that the efforts in this province in the development of a science-minded clientele and an increasing awareness of science in education in the schools is extremely important. I mention it because I know that the Science Council of Canada has adopted a development policy for the sciences and technology in the schools. The problem is, if we are not very careful, that we are going to try to establish a science policy for the province without adequate consideration of the implications of this policy for science education in the school system.

I personally do not see the need for a PRO, but I do see the need for a Science Council that is very small with a capability to call on expertise and draw on the existing mechanisms for consultation and advice. It should be linked directly to the Cabinet at the top level. It must, above all things, have Cabinet support and it must have absolute control as to how its budget is allocated, with an eye to identifying those areas which, in the future, will become very important. The people involved will have to know what is happening in science to recognize the specific expertise which Newfoundland needs to understand the market needs, and be competent to balance these to create a flexible operating policy or policies.

I would not like to say where the finances should come from. Most of us are well aware of the present state of the economy and I cannot see any simple diversion of funds being made from any single source as being the answer.

In terms of the composition of the council, I would again be very cautious, but I would say that we must have people with scientific expertise who will accept political advice, who know what the needs are of the province, and who are not afraid to speak their minds.

Peters: Our panel this morning sought not so much the description of what they do, but sought the advice of representatives of other provinces which have such organizations. The three provinces showed diverse approaches but a surprising commonality of problems and advice. They showed many ways in which we should be cautious of moving. I would say as well that I am sure there are other provinces, if they had been here, which would have had other aspects to bring to the fore, particularly, for example, Ontario, which is not really a province comparable to our own; they have a long-standing organization and might conceivably have a different view. Nevertheless, I think the advice we got this morning was obviously generated from a lot of thought and consideration

within the experience of these three provinces.

We must not forget the very first statements that Dr. Pepper made: "Let's not just make a first step. Movement is all very well but one step doesn't get you very far, unless you have a very short-term objective. Be sure that you have the courage to carry on and bring it to a proper conclusion, and not just make a beginning".

I have five points in which I will try to consolidate the main advice that we got.

(1) Structure. Structure of whatever we propose to do, advisory council or otherwise. There was no advice that this shouldn't be done at all. Ivan's first question on the first morning of why do this, or should we do it at all, is by and large answered in this way. We should do it. We shouldn't just drop the whole idea. What should the structure be? An advisory council and/or a PRO so-called. Saskatchewan has both, but the advisory council appeared not to work very well. In the other two provinces represented, the PRO board or council equivalent serves both advisory and administrative roles for their own particular organization, at least at the managerial board level.

If we get an advisory council, it is important that it be properly connected to a high level in government and probably not to a line department. This was a strong point. It seems to me that we could reasonably draw on advice that an informed advisory council well connected with some clout, that means with access to some money, would be probably a good beginning. A PRO might come later if necessary. You may not all agree that that was the tenor of the advice. That's just the way that I saw it.

(2) Maximizing technology transfer. A difficult problem but essential. There is a large gap between the science and engineering and the research activities and actually getting economic development from them. I think many of us are well aware of that. The managerial skills are very necessary in the successful entrepreneurship that must go on to bring about economic development and mustn't at all, at any time, be forgotten. Science and technology of itself won't necessarily make a dollar. Listening to the ways in which these councils interact with their communities, I'm led to believe that it has to be a people-to-people transfer. It is not sufficient to just produce good reports and good science and good technology papers, conferences, and so on and leave it there. The research people have to work with the people in the businesses and, by people-to-people transfer, you get economic development and industrial development rather than simply having two camps and passing bits of paper back and forth. The approach mentioned in the White Paper - the leap-frog approach - was only alluded to once or twice. Several people mentioned it during the conference and once this morning someone said: "yes, that's a good idea but be careful". One point wasn't mentioned, but I think should be mentioned anyway, that the leap-frog approach has its biggest hazard in that you may leap over the problem definition stage. That stage is very essential. Finding the problem may be half the solution. If you have a leap-frog approach and you buy somebody else's technology, you may solve the wrong problem. You may have bought a solution before you've defined the problem. I think that is a hazard to be well aware of.

(3) Facilities. Common facilities - shared facilities. It is almost a foregone conclusion that this would be a good thing. If you have facilities in the community, they should be shared in this area. The three councils that were represented here did share facilities both in purchasing equipment, as in New Brunswick, and in sharing lab space with the private sector, as in Manitoba.

Shared facilities are generally encouraged.

(4) Priorities. Our White Paper came down very narrowly focusing on marine sciences as a priority. The question of basic or applied wasn't really addressed this morning because these organizations were mostly involved in applied work. In any event, priorities in the marine area are sensible, reasonable I suppose, in this environment, but we were cautioned several times. Don't be too narrow; don't be too narrow! Social impact has of course to be considered. Economics are there because they are always there. If you are involved in economic development, you have to consider the economics of what you do. Don't define the priorities too narrowly. Consider social impact, but possibly don't be too concerned with social research per se.

(5) Something that wasn't mentioned at all. There was very little input at all for this whole conference from the private sector. I think we should hear more from the private sector.

Palmer: I should say that this was a limited invited audience or selection of participants focusing principally on government people, the university people, and a number of people from the private sector or, specifically, the marine technically oriented area. This kind of discussion, I propose, will go ahead further with the private sector, not necessarily in this kind of format. It will also go ahead with the members of the business community at various times in the months to come. I think those others will benefit a lot from what has been brought out here. I would like, at this point, to throw the meeting open to further discussion and solicit points which have arisen during this panel and overspill questions and comments from previous sessions.

Comment from the floor: We need a Science Council and we need it immediately but we need people on it who are involved with the new technology of the 21st century, that should be able to accept criticism, and should be able to educate our people, should be able to educate other government departments, especially if they are line departments. We have to have financial support which will last for several years. A PRO we don't need. Maybe we will need one in 15 years but not now. We don't have a large amount of industry to support like Manitoba. We have qualified people from the university to take us through the next decade. We have to develop trust and a good relationship between government, business and the university for the small businesses who come here. Financially, we don't have the investment capital. We are willing to trade $ for $. Technology transfer work is slow. Through the White Paper, we are off to a good start and should immediately start a real program to get things off the ground.

Pepper: From my own experience, being involved with the Science Council of Saskatchewan, the Minister said "now that we have the Science Council, all of our problems are going to be solved". Unfortunately, we were not able in any way to meet the expectations of the Minister. The resources that we needed were just not there. I suggest that you evaluate the resources that you have and be realistic about it. That is the best advice that I can give you.

Coderre: On technology transfer. I would like to make a very strong distinction between government contracting out and technology transfer. Contracting out is the way government gets industry to work for government.

Russell: I would like to comment on a couple of things Rick W. said. He said that we don't need a PRO now, but maybe in 15 years, for the reason that we don't have an industry in the province that can utilize the results. Well, I disagree entirely with that. I think that there is an industrial base in the province that could utilize results if done the right way and, secondly, we are

developing industry in this province and a PRO would be a key catalyst in doing that. Rick also mentioned that the university is sufficient to provide the role of the PRO, that it has done that and will do it. I think that is a ridiculous statement. The university cannot, unless it becomes a different organization completely from what it is, provide that function. The university's main role is not to carry out applied R & D and get those results into industry in the province. If that were the main role of the university, fine, I don't think we would be talking about the establishment of a PRO. I don't think we would be having this discussion here to a great extent. So I think the university plays a very, very important role, but under no circumstances should it be considered now, or in the future, to play the main role in transferring R & D results into industry.

Comment from the floor: I would like to suggest that one thing the PRO could do would be to reach down into the school system and educate our children better. Perhaps we should have a scholarship fund. Why not have the mining, fisheries, lumber and other sectors contribute to the fund? Why not request individual departments to set up this fund? Let it be used for the students to do research.

Comment from the floor: We must do something to ensure that a place is retained for the urban and rural life styles.

We also have a manpower problem. We should not be exporting all of our graduating students to Alberta, but rather keeping them here. I see several problems in the education system. Undoubtedly, many of the students come in from Canada and other parts of the world to work. Council should look at where we are going to get this manpower from. Most of our teachers do not have a degree in science, so how can we train people in science? Less than 10% of our teachers have a degree in science. The White Paper does not address this at all.

Heald: The White Paper should not focus too narrowly. Could we have told 7 or 8 years ago that we needed these people today? Manpower needs projections are not accurate.

Comment from floor: On science education for high school students. 90% of students who come out of our school system do not go into careers based highly on science. These are the doctors, lawyers, workers in management positions, etc. It is not unique to Newfoundland. We are looking at 10% or fewer who eventually become engineers or scientists. The others mostly become politicans, etc. Everyone needs scientific knowledge, including the housewife who needs a little science to go to the supermarket. We need to get a proper attitude in the province towards science education.

APPENDIX I

List of Attendees*

Dr. F. A. Aldrich
Dean of Graduate Studies
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Mr. C. Barnes
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M.U.N.

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Faculty of Medicine, M.U.N.

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Environmental Biologist
Department of the Environment

Mr. Ira Bridger
Industrial Benefits Co-ordinator
Petroleum Directorate

Dr. M. H. Brooker
Vice-Chairman, Atlantic Region
Chemical Institute of Canada

Mr. Albert Burgess
General Manager
Newfoundland Dockyard

Mr. Bill Campbell
Mines Managers Association

Mr. John Capps
President
N.O.I.A.

Mr. R. Cashin
President
Newfoundland Fishermen Food
and Allied Workers

Dr. T. Chari
Faculty of Engineering
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M.U.N.

Dr. W. M. Coderre
Manager, Industrial Development
National Research Council

Mr. Gordon Cross
National Research Council

Mr. Bob Dempster
Dean, Faculty of Engineering &
Applied Science
M.U.N.

Mr. Joe Doyle
President
Nfld. Forest Protection Assoc.

Mr. P. Dufour
Science Council of Canada

Mr. Kenneth Duggan
President
College of Trade & Technology

Ms. Christine Fagan
President
Board of Trade

Mr. J. Fitzgerald, P. Eng.
Assistant Deputy Minister
Intergovernmental Affairs Secretariat

Mr. John Fleming
Assistant Deputy Minister
Department of Mines & Energy

Mr. N. French
Regional Director
Energy Mines & Resources

Mr. Jan Furst
President
Jan Furst Marine Consultants

Mr. B. Garland
Product Development Specialist
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Mr. C. Gaulton
Supervisor
Training Resources Development
Department of Education

* Editors apologize for any errors or omissions.

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Mr. T. Graham
Program Co-ordinator
Department of Rural Agricultural
& Northern Development

Mr. Eric Gray
President
Fenco

Dr. Richard Haedrich
Biology Department
M.U.N.

Dr. Leslie Harris
President
M.U.N.

Mr. W. R. Haynes
Assistant Deputy Minister
Department of Municipal Affairs

Dr. P. Heald
Dean of Science
M.U.N.

Mr. V. Hollett
Deputy Minister
Department of Public Works
& Services

Mr. Brian Holmes
Regional Director General
Department of Industry, Trade
& Commerce

Mr. Lorne Humphries
Regional Director
Coast Guard

Dr. D. Idler
Director
Marine Services Research
Laboratory

Mr. James G. Kennedy
President
Association of Professional
Engineers of Nfld.

Mr. Bill King
Vice President, Sales
Kue Engineering

Ms. B. Knight
Director, Resource Programs
Intergovernmental Affairs Secretariat

Mr. B. LeDrew
LeDrew Environmental Management Ltd.

Mr. D. J. LeRoy
Science Council of Canada

Mr. C. Lester
Research Policy Analyst
Cabinet Secretariat

Dr. Peter Lewell
New Brunswick Research &
Productivity Council

Dr. J. Lewis
Research Director
I.C.E. Engineering

Mr. Bill Lukeman
President
Hydrospace

Mr. Collin MacKenzie
Chairman
Newfoundland & Labrador
Explorationist

Mr. C. J. McCormick
Assistant Deputy Minister
Department of Education

Mr. H. McGonigal
Director General
Dept. of Regional Economic
Expansion

Mr. John McKillop
Deputy Minister
Department of Mines & Energy

Mr. M. C. Mercer, Director
Research & Resource Services
Fisheries & Oceans Canada

Mr. Harold Miller
President
Computer Services

Mr. W. Milne
Professor
School of Shipbuilding Engineering
M.U.N.

Mr. Gerald C. Morgan
Regional Director
Agriculture Canada

His Worship Mayor John Murphy
City of St. John's

Dr. E. R. W. Neale
Vice-President, Academic
M.U.N.

Mr. D. Neilson
Director
Department of Rural Agricultural
& Northern Development

Mr. Frank Nolan
President
Nfld. & Labrador Development Corp.

Mr. Ken Oakley
Director
East Coast Petroleum Operators
Association

Mr. F. J. O'Keefe
General Manager
Eastern Technical Services

Mr. L. G. O'Reilly
Vice President
College of Fisheries

Mr. C. Palmer
Analyst
Intergovernmental Affairs Secretariat

Mr. Bert Peach
Manager of Administration
S.B.R. (Shawmont)

Dr. T. P. Pepper
Executive Director
Saskatchewan Research Council

Mr. Bob Peters
Secretary to Cabinet Resource
Policy

Dr. R. D. Peters
Associate Dean
Faculty of Engineering & Applied
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Mr. B. Power
Director
Indus. & Envir. Engineering
Department of the Environment

Mr. G. Ross
Forest Improvement Specialist
Department of Forestry

Dr. W. Russell
Director of Engineering Systems
Petroleum Directorate

Mr. David Sharpe
President
Canadian Institute of Forestry

Mr. O. Silverman
Director, Industrial Projects
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Mr. Gordon Slade
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Mr. P. Smith
Research Engineer
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Mr. Richard D. Worsfold
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Remotec Applications

Dr. Adam Zielinski
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Association of Professional Engineers
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Mr. G. Cochrane, Director
Metric Conversion & Standards
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Mr. H. M. Clarke
Deputy Minister
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Mr. Ivan Palmer
Assistant Deputy Minister
Department of Development

Mr. Fred Murrin
Senior Development Officer
Department of Development

Mr. Mike Shawyer
Marine Industries Officer
Department of Development

Ms. Marian Barry
Promotion Group
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Mr. R. Pottie
Atlantic Regional Director
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APPENDIX II

SUBMISSIONS AND COMMENTS RECEIVED IN RESPONSE TO THE PROVINCE'S WHITE PAPER

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Mr. L. Harris
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POOR

QUALITY

ORIGINAL